AMERICAN MACHINIST

A PRACTICAL JOURNAL OF MACHINE CONSTRUCTION.

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VOLUME 21. NEW YORK, THURSDAY, JANUARY 13, 1898. NUMBER 2.

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Casting a Fly-Wheel.

I had recently the pleasure of visiting the foundry at Bristol, Conn., of the Sessions Foundry Company. The immediate occasion of my visit was an invitation to witness the pouring of a big fly-wheel. I saw what I went to see, and I also availed myself of the opportunity to look over a modern and a model foundry plant. The establishment illustrates in a striking way the change that has been in progress in the conditions of successful foundry practice. An iron foundry is now seldom run, and can no more be run profitably and successfully, as a side show in connection with a machine shop or a steam engine works unless those establishments are upon a magnificent scale. The foundryman's art has grown in scope and in importance. He has in these days to know so much, to assemble such a variety of materials, such facilities and such a range of special skill that the small foundries, if not necessarily disappearing, are at least confined within narrow lines of production.

The Sessions foundry is an isolated plant for the production of iron castings in great variety, and it produces nothing else. It is not dependent upon a local trade, but finds its customers throughout the New England and Middle States, or wherever the modern facilities of transportation may reach. All its supplies come to it by rail, and all its output is distributed by the same means. Here are thirty acres of land, to begin with, alongside the main track of the New England Railroad, with a branch into the grounds, a mile and a quarter of private track, and a special locomotive in constant use. The main foundry building, in which all the molding and casting are done, is 530 feet long and 112 feet wide. There is a wing on each side 24 feet wide and 18 feet high, clear of the trusses, and a central space 64 feet wide and 30 feet high. The cupolas, of which there are at present five, are in the north wing and inclosed by brick walls, so that only the tapping spouts appear in the foundry. Fig. 1 is a good general view of the foundry interior, looking toward the west end. Between the cupolas are the core rooms and the core ovens, and in this wing near the middle is also located a very fine washroom for the men. Practically all of the floor space except this north wing of the building is available, and is used as a molding floor. Two 25-ton cranes command the central space for more than half the length from the eastern end. The west end is used for light work. There is a central wall through the middle of this end, and on each side of it are hand lever molding machines, or "squeezers," to the number of forty or fifty. The cupola for most of the light castings is located conveniently nearly half way down this end, while the largest cupolas are toward the eastern end. The cupola rooms have two floors above the ground. The first is the charging floor, while on the floor above are located a Baker blower and an electric motor, each cupola thus having its own independent blast. The traveling cranes are electrically driven, as are also the pattern shop, machine shop, tumbling barrels for slag in the yard, and, in fact, everything except the tumbling barrels for the little castings, the room in which they are located being next to the engine room, so that it was convenient to run a small line shaft directly into it. There are several hydraulic jib cranes in the eastern end of the foundry. Tracks along the eastern side of the building deliver either at the ground level, which is used for sand storage, or at the level of the charging floors for coke and iron.

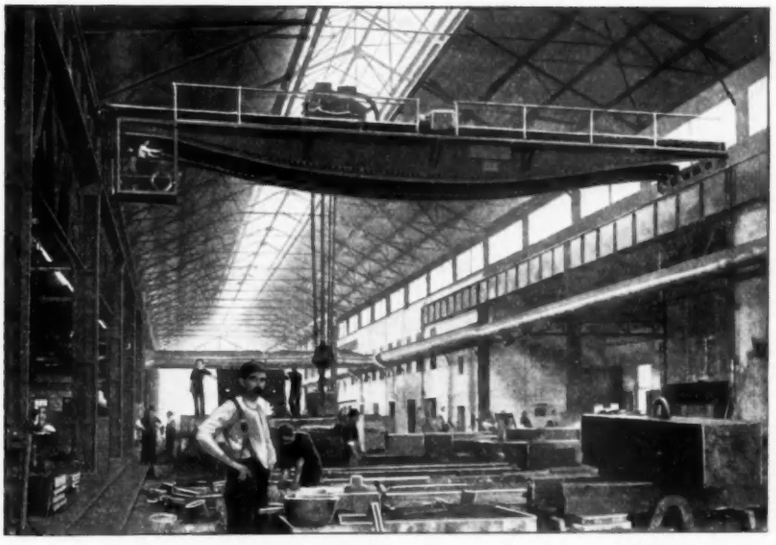


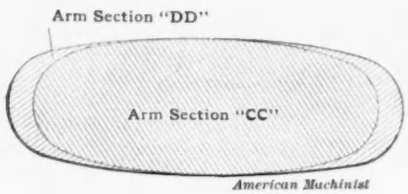
FIG. 1.—INTERIOR OF FOUNDRY.

On the south side of the main building are ranged the engine and boiler house, the tumbling house, sorting room, shipping room, cleaning and shipping room for the larger castings and the pattern and machine shops. Railway tracks, sunk to bring the car platforms to the floor level, command the buildings on this side. The several buildings enumerated with the main building occupy nearly a rectangle. There is a large pattern storage house, still farther south, and the handsome stone office building beyond that. All the buildings are connected by covered ways, and a system of narrow gage tracks extends through the entire works. The office has, of course, all the modern appliances, including telephones to various stations and pneumatic dispatch tubes to the different departments. The buildings are handsome and beautifully kept, and a fine lawn in front gives a neat finish to the entire establishment.

I cannot properly at present take up more extended space with an attempt at a description of this interesting plant. The fly-wheel with which this account has to do was one of six, precisely alike,

which were embraced in a single order and cast consecutively, and within a short period of time, for the Providence Steam Engine Company, and every casting was a good one. The habit of seldom losing a casting is a most important element in the financial success of a foundry, and an important factor also in successful competition with the old-school foundries. The half-tone, Fig. 2, shows a fly-wheel casting suspended in the foundry, with the foreman in the middle in front of it, the assistant foremen at the sides. The working drawing, Fig. 3, shows all the necessary details of the wheel. It will be seen that the finished wheel has the faces of the rim planed and brought snugly together, while the halves of the hub, whose faces also are planed, do not touch. The rim is turned all over, and the finished outside diameter is precisely 18 feet. Steel links are shrunk on each side of the rim to hold it together, and also another link inside the rim. The bolts tapped into the joint on the inside of the rim on each side are practically steady-pins to keep the two parts in match with each other, although there could be no reason for their moving after being once properly brought together. A 3-inch keyseat is cut in the middle of each half of the hub. The finished weight of the wheel is 63,000 pounds.

The wheel, although molded and cast as a whole, is not cast perfectly round, allowance being made for the necessary planing to bring the halves properly to-



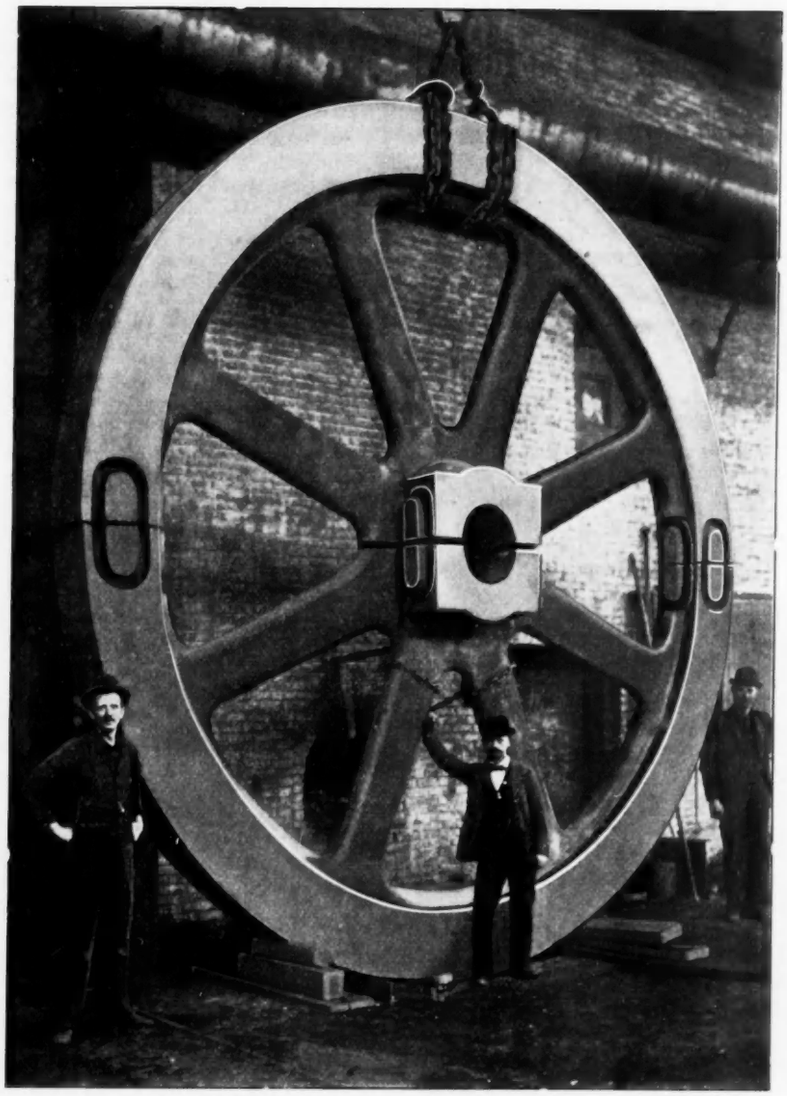


FIG. 2.—JUST OUT OF THE SAND.

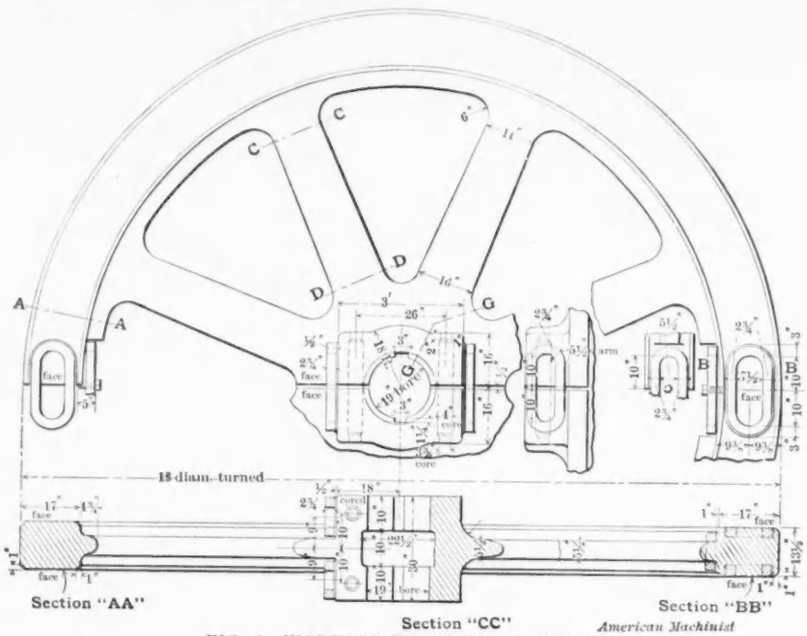


FIG. 3.—WORKING DRAWING OF WHEEL.

gether after they are broken apart. The faces are in fact entirely separated by their flat cores, two 2-inch runners, which permit some equalizing flow of the metal during the pouring, being the only connection. Notwithstanding that the halves of the wheel are thus practically separate castings, the wisdom of casting together is self-evident. The operation is cheaper and quicker than that of molding separate halves, the castings must be perfectly homogeneous and of the same size; they will be of equal density and weight, so that they will come together better and balance better than two separately cast halves could possibly do.

The excellent photo which is reproduced in the large half-tone, Fig. 4, tells the story of the construction of the mold with great fidelity and clearness. The permission to publish this photo is an admirable illustration of the liberality of the American manufacturer. There can be little doubt that many a foundryman on either side of the

water will learn something from it; and, whatever business caution may suggest, it is hard to say who will lose anything by it. The photo of the half-completed mold of course tells much more than a picture of the mold complete and ready for pouring could do. It will be seen that the mold is practically made up entirely of cores, all the pattern work for the wheel being the making of core-boxes; the work of the molder consists in properly bedding, setting, securing and

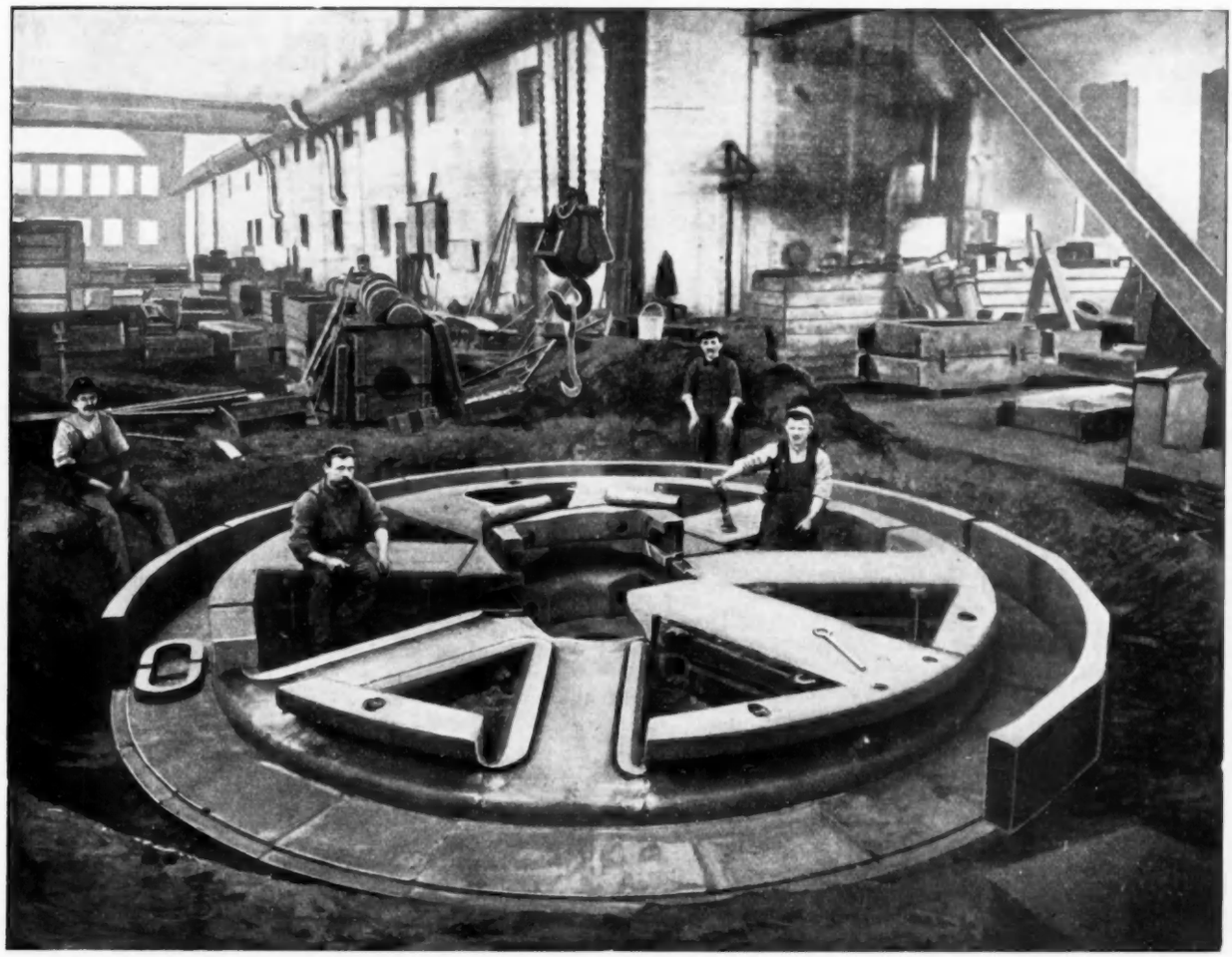


FIG. 4.—PUTTING THE CORES TOGETHER.

covering the cores, and the wheel is, throughout, a dry-sand casting.

The mold is made in one of the great sand pits provided in the foundry floor, this one being about midway between the large cupolas. The mold is shown with most of the cores already in place, enough pieces being left out in the front to show the entire construction of the mold. A vertical spindle, or standard, is first set up in the centre, and by means of sweeps revolving around it a perfectly hard and level bed is first provided. The central spindle is eccentric to its bearings, to provide for the eccentricity of the two halves of the mold. The location of one-half of the mold is secured with the spindle in an extreme position, and for the other half of the mold the spindle is turned half way around. Slabs of core for the lower side of the rim and for the end of the hub are securely bedded. The other cores forming the outside and the inside of the rim are then laid up with the boxes of core material which form the arms and the entire core inclosure for the hub. The halves of the cores for the arms are clamped together by vertical bolts at each end, suitable plates or straps with eyes being made into the cores for the purpose. The rim is covered with flat slabs of core similar to those below, the surface above them is leveled up with sand and the sand is rammed in both outside and inside the rim. Short bars of railroad iron are laid radially and pretty close together above the rim all around, and the whole is weighted down with heavy weights. As the runner has a head of probably 3 feet the upward pressure of the molten iron at the rim will be understood, and the necessity of the weighting is evident.

The wheel is poured entirely at the hub. The size of the runner, or of the two runners to the opposite halves of the hub, may be inferred from the fact that the actual time occupied in pouring the wheel was less than two minutes. From the central runner a pouring channel about a foot wide extended, level, or with a slight incline, to each side of the wheel for the convenience of the ladles. This channel was laid lengthwise of the foundry, or in the direction of the travel of the cranes. One large ladle was located at each end of it, or at each side of the wheel. The iron was brought from the cupolas in smaller ladles, three or four tappings from each cupola, and the large ladles were not lifted except for the actual pouring. This is an operation so simple, and with the aid of the two 25-ton cranes, so easily accomplished that it is difficult to realize the responsibility of the moment or the co-operative combination of skill in the operators with the judgment of the foreman in charge. The hoisting of the ladle and also the necessary movement of it forward or backward is dependent upon the crane runner, while the tipping of the ladle and the rate of flow of the metal is controlled by the man at the ladle. The pouring is begun by one of the ladles with a stream nearly a foot wide and 3 or 4 inches thick, and although the

mold calls for nearly 140 cubic feet of molten iron the stream is soon exhausted. Before the ladle is quite empty the second one has begun to deliver its contents, the principal item of instruction to the man in charge of it being to keep the runner full. This ladle empties apparently nearly as rapidly as the other, and when its contents have nearly all disappeared the spectator indulges in a moment of anxiety as to the sufficiency of the supply of metal; but it begins to flow from the risers just as the ladle is emptied, and the nice calculation as to the quantity required is vindicated.

The weight of this wheel was of course no test of the capacity of the foundry to produce heavy castings. The only visible limit would be in the ability of the railroads to transport the castings after they were made. The cranes in this case handled the entire charge of metal in the two ladles with perfect ease. For still larger castings standing ladles at a sufficient elevation, with gates and suitable leaders to the mold, could of course be employed. The pouring of a larger wheel, or of similar heavy castings, being a familiar and every-day occurrence at this foundry it did not interfere with the routine work going on in other parts of the floor. Not far from the wheel was a large low-pressure cylinder poured two or three days before and not yet fully uncovered. A little further on they were laying up a loam mold of another cylinder. The pouring of castings of various weights for electrical and other service was also going on. The foundry makes both the heaviest and the lightest castings that customers can call for, and anything between. Their advertised range of "from 40 tons to a quarter of an ounce," or 5,120,000 to 1, is easily within their limit. There were on the floor at the west end, as near as I could calculate, and as I was also told, about 9,000 molds of small work, all put up that day and mostly made in snap flasks, and the molders were pouring them with hand ladles. The patterns for this work were in cards, and some were so small as to have three of these cards to a snap flask. I saw one man pour twelve of these molds, with three separate sprues to each, with one ladleful of iron. R.

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Progress in Gun Making.

On testing the 8-inch Haskell multicharge gun in February last, by the Board of Ordnance and Fortification of the War Department, only two rounds were fired, and at the second round the metal between the forward pocket and the bore was found to have been crushed in; this rendered the gun unserviceable. The Board has declined to make a recommendation for any further expenditure on multicharge guns, believing, as it does, that smokeless powder has in a great measure obviated the necessity for the multicharge gun.

The 8-inch Gatling gun provided for by the Act of June 6, 1896, is now under process of construction.

The mill for hot rolling the segments to be used in the manufacture of a 10-inch Brown segmental tube, wire-wound gun, also the machine for winding wire on the gun with the requisite initial tension, are completed, and the wire and steel for the segments have been made. The lining tube is now in course of construction at the works of the Bethlehem Iron Works. It is expected that the gun will be ready for test about July 1, 1898.

The Bethlehem Iron Company is also making excellent progress on its 100 gun contract of recent date, and it is expected that these guns, consisting of twenty-five 8-inch, fifty 10-inch and twenty-five 12-inch guns, will be completed and delivered considerably in advance of the contract time.

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Modern Practice with Worm Gearing.

BY F. A. HALSEY.

Several references have of late appeared in these columns to the fact that, in the face of the good results now being obtained, the old prejudice against worm gearing, on account of its supposed low efficiency and short life, is dying out. These good results are the outcome of the application of principles which are by no means a late discovery, and it is expected that the following article will contain much that to some of the readers of this paper is not new. At the same time it is an undoubted fact that the best practice with worms is understood by but few, relatively speaking, and some of the illustrations to follow are believed to be new. No better illustration of the fact that good practice with worm gearing is not yet widely understood could be given than the statement in a recent and excellent work on gearing that "the diameter of the worm is commonly made equal to four or five times the circular pitch," the fact being that such proportions are distinctly bad if hard work is to be done.

It should be stated at the beginning that while the following article is not offered as a presentation of all the data necessary for assured success with worms under all conditions, it is hoped in it to make the general conditions of successful practice plain, and to present the "state of the art" as it exists to-day.

The essential change in practice which has improved the results obtained with worm gearing has been an increase in the pitch over what was formerly considered proper. There is no doubt whatever that this change has increased the efficiency of the gear, and, what is of more importance, has reduced the tendency to heat and rapid wear. This is not only a fact, but it is a sound conclusion from theoretical considerations, which might have been predicted under proper examination.

THEORY OF WORM EFFICIENCY.

The reason why an increase of pitch, other things being equal, or in other words, an increase of the angle of the thread, gives these results, will be understood from Fig. 1. If *a b* be the axis of the worm and *c d* a line representing a thread, against which a tooth of the wheel bears, it will be seen that if the tooth bears upon the thread by a presure, *P*, that pressure may be resolved into two components, one of which, *e f*, is perpendicular, while the other, *e g*, is parallel to the thread surface. The perpendicular

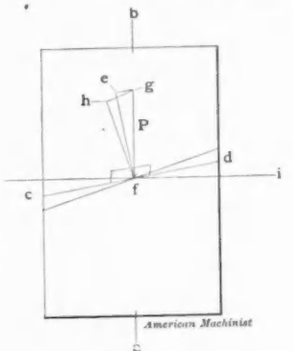

Fig. 1

THE PRINCIPLE OF WORM EFFICIENCY.

component produces friction between the tooth and the thread. The useful work done during a revolution of the thread is the product of the load *P* and the pitch of the worm, while the work lost in friction is the product of the perpendicular pressure *e f*, the coefficient of friction and the distance traversed in a revolution, which is the length of one turn of the thread. Now, if the angle of the thread be doubled, as indicated, the load *P* remaining the same, the new perpendicular component *f h* of *P* will be slightly reduced from the old valve *e f*, while the length of a turn of the thread will be slightly increased. Consequently their product and the lost work of friction per revolution will not be much changed. The useful work per revolution will, however, be doubled, because, the pitch being doubled, the distance traveled by *P* in one revolution will be doubled. The ratio of the lost work to the useful work is therefore reduced by the increase in the thread angle, and since the tendency to heat and wear is the immediate result of the lost work, it follows that that tendency is reduced. For small angles of thread the change is very rapid ,and continues, though in diminishing degree, until the angle reaches a value not far from 45 degrees, when the conditions change and the lost work increases faster than the useful work, an increase of the angle of the thread beyond that point reducing the efficiency.

This general consideration of the sub-

ject shows the principles at the bottom of successful worm design, but a more exact examination is desirable. According to Professor Barr the efficiency of a worm gear, the friction of the step being neglected, is:

$$e = \frac{\tan a\ (1 - f \tan a)}{\tan a + f}$$

in which,

e = efficiency

a = angle of thread being the angle $d\ f\ i$ of Fig. 1

f = coefficient of friction.

To study the effect of the step, a convenient assumption is that the mean friction radius of the step is equal to that of the worm. This asumption would only be realized in cases where the step is a collar bearing outside the worm shaft, and the preceding and following formulas therefore represent extreme cases, one of a frictionless step, which would be approximated by a ball bearing, and the other of a step having about the extreme friction to be met with. Most actual cases would therefore fall between the two. Again, according to Professor Barr, the efficiency of a worm and step on the above assumption is:*

$$e = \frac{\tan a\ (1 - f \tan a)}{\tan a + 2f} \text{ approximately}$$

Notation as before.

* The derivation of these formulas is somewhat involved and need not be given here. It should, however, be stated that they assume the thread of the worm to be square. Thread profiles in common use affect the results but little.

These formulas give no clear indication of the manner in which the efficiency varies with the angle, and the diagram, Fig. 2, has been constructed to show this to the eye. The scale at the bottom gives the angles of the thread from 0 to 90 degrees, while the vertical scale gives the calculated efficiencies, the values of which have been obtained from the equations and plotted on the diagram. The upper curve is from the first equation, and gives the efficiencies of the worm thread only; while the lower curve, from the second equation, gives the combined efficiency of the worm and step. In the calculation for the diagram it is necessary to assume a value for f, and this has been taken at .05, which is probably a fair mean value. The experiments made by Mr. Wilfred Lewis for Wm. Sellers & Co. showed an increase of efficiency with the speed. The present diagram may be considered as confined to a single speed, and at the same time is not to be understood as showing the exact efficiency to be expected from worms, but rather to exhibit to the eye the general law connecting the angle of the thread with the efficiency.

The curves will be seen to rise to a maximum and then to drop. The exact values of the angle of thread to give maximum efficiency may be easily found by the methods of the calculus, the results being:

For worm thread alone the efficiency is at a maximum when

$$\tan a = \sqrt{1 + f^2} - f$$

Substituting the value of f used in calculating the diagram — .05 — this becomes

tan × per maximum efficiency = .9512,

and by referring to a table of natural tangents we find that,

a for maximum efficiency = 43° 34′

Similarly for the worm and step the result is,

tan a for maximum efficiency $= \sqrt{2 + 4f^2} - 2f$ which for $f = .05$ $= 1.318$

and a table of tangents tells us again that

a for maximum efficiency = 52° 49′

Of more importance than the angle of maximum efficiency is the general character of the curves, of which the most pronounced peculiarity is the extreme flatness, showing that for a wide range of angles the efficiency varies but little. Thus, for the upper curve there is scarcely any choice between 30 and 60 degrees of angle, and but little drop at 20 degrees.

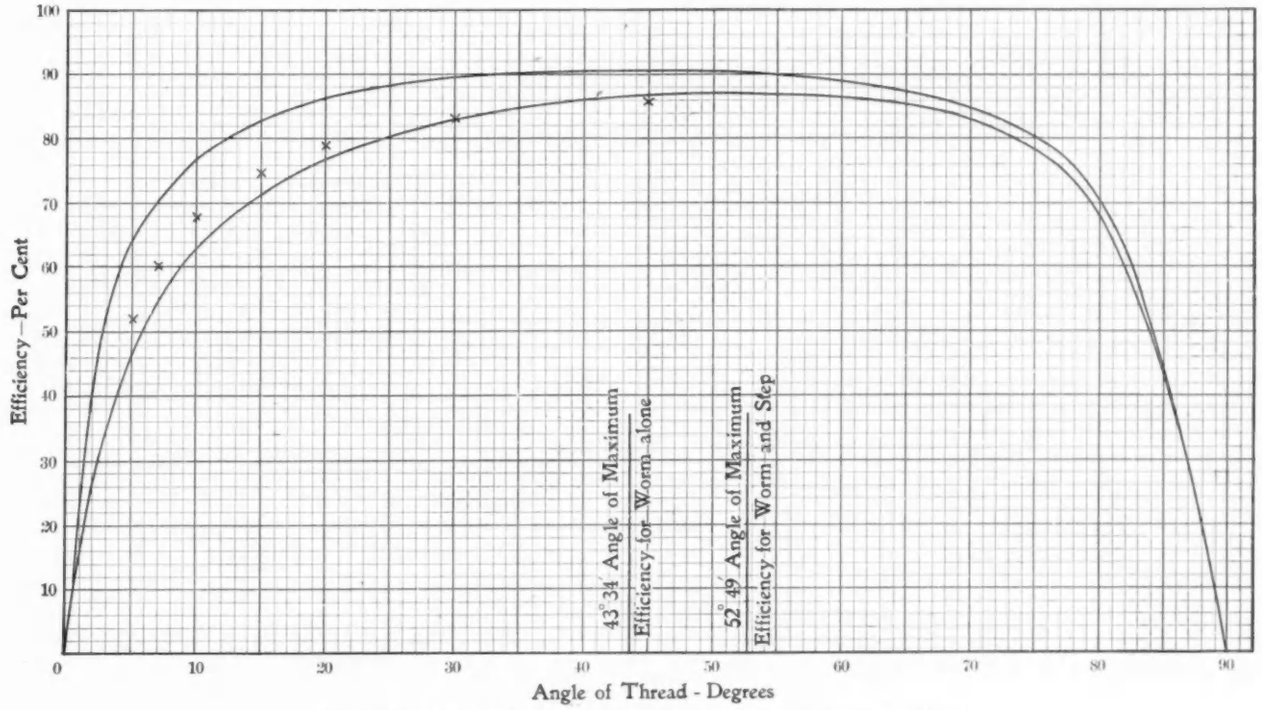

FIG. 2.—RELATION BETWEEN THREAD ANGLE AND EFFICIENCY.

At first sight the lower curve might be thought the most useful of the two, as it includes the effect of the step, but a little consideration will show that this is not the case. For most cases in which worms are used the efficiency of the transmission, as such, is of very little account. What the designer concerns himself with is the question of durability and satisfactory working, and the results to be expected in this respect are best shown by the upper curve, in which high efficiency means a durable worm. Throughout this article, in fact, the chief significance of efficiency

lies in the fact that low efficiency means rapid wear, and vice versa.

EXPERIMENTAL CORROBORATION OF THE THEORY.

The experiments of Wm. Sellers & Co., before referred to, go far to confirm the soundness of the above views. From the present standpoint it is unfortunate that those experiments did not cover a wider range of worm thread angles—those actually used being 5 degrees, 7 degrees and 10 degrees. Other experiments were, however, made on spiral pinions of higher angles, spiral pinions being understood by Mr. Lewis to mean those pinions having the mating gear a true spur, the pinion shaft being at a suitable angle with the gear shaft to bring the pinion in proper mesh—a construction which is exemplified in the well-known Sellers planer drive. Mr. Lewis gives a formula by which the efficiencies of worms can be calculated from those for spiral pinions, and in the absence of direct experiments on worms of high angles, his results for spiral pinions have been modified by this formula to read for worms. The results for the two forms of gearing differ by less than 5 per cent. for the extreme case of his experiments. To compare the results obtained by Mr. Lewis with Professor Barr's formula, a speed has been selected from the experiments giving the nearest coefficient of friction to that used in obtaining the curves of Fig. 2. The results have been plotted in Fig. 2, where they appear as small crosses, and will be seen to have a very satisfactory agreement with the lower curve, with which they should be compared, as the steps of the worms used by Mr. Lewis were of the usual pattern without balls.

The variation of the coefficient of friction with the speed lends an interest to Fig. 3, which is a series of curves obtained from the results published by Mr. Lewis in the same manner as the crosses of Fig. 2, the curve for 20 feet velocity being in fact the same as that appearing as crosses in Fig. 2. The other curves of Fig. 3 are obtained from those of Mr. Lewis, and cover a range of velocities from 3 to 200 feet per minute at the pitch line, as noted at the right. In this diagram the results obtained by Mr. Lewis on worms are plotted direct, but the experiments on spiral pinions have been modified as explained above. Inspection of the curves shows that while there is a progressive increase of efficiency with the speed, there is, nevertheless, not much probability, or indeed room, for further improvement beyond the speed of 200 feet per minute. It will furthermore be seen that the efficiency drops off much less for low angles of thread at high speeds than at low.

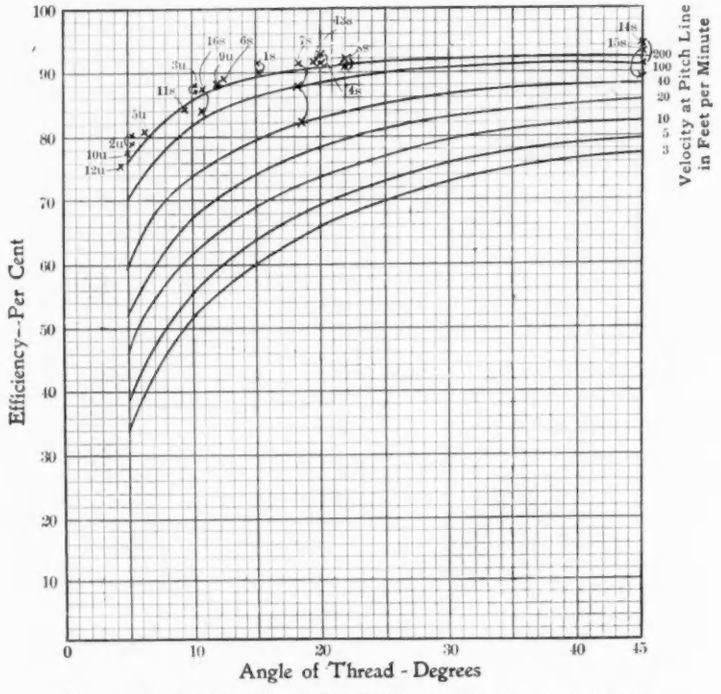

FIG. 3.—RELATION BETWEEN THREAD ANGLE, SPEED AND EFFICIENCY, WITH CASES FROM PRACTICE.

In interpreting this diagram, it should be remembered that the durability of a worm depends upon the amount of power lost in wear, and not upon the percentage so lost. The ability of a given worm to absorb and carry off the heat due to friction is fixed, and does not vary with the speed. That is, a given worm running at 100 revolutions under a given pressure can cary off as much friction heat as the same worm at 200 revolutions, while it, under the same pressure, would transmit but one-half the power in the former case that it would in the latter. In other words, the percentage of lost work might be twice as much at the lower speed as at the higher without increasing the tendency to heat.

The increase of efficiency with the speed is a valuable property of worms, and enables them to do much more work than they otherwise would. Thus the 20 degree worm at 20 feet per minute lost 21½ per cent. of the work in friction. Increasing the speed to 40 feet doubled the work applied, and, had the efficiency remained constant, would have doubled the friction heat to be dissipated. In point of fact, this increase of speed diminished the percentage of loss to 17, and the amount of loss and heat, instead of being doubled, was only increased in the ratio of 160 to 100. It is plain from the diagram, however, that this action does not continue much beyond a velocity of 200 feet per minute, beyond which the amount of loss must be more nearly proportional to the speed, and this doubtless has some connection with the fact observed by Mr. Lewis that 300 feet per minute is the limit of speed when the gears are loaded to their working strength, and that the best conditions are obtained at about 200 feet per minute. It is proper to add, however, that in the cases from practice given later there are three which have been made repeatedly, and which are conspicuously successful, in which the velocity exceeds 600 feet, and one in which it exceeds 800 feet. No doubt, in all such cases, if the pressure on the teeth could be known it would be found to be light.

It will be seen that an increase of speed for any worm under constant pressure leads to an increase of friction work, and the limit is reached when the worm is no longer able to carry off the heat generated fast enough to prevent undue rise in temperature. Furthermore, this limiting speed depends upon the pressure, it being higher for low pressures than for high. A worm having an angle which might be successful at low speed may fail at high speed; but it would seem that any worm which is successful at high speed should also be successful at low, which is in accordance with mechanical instinct.

(Concluded next week.)

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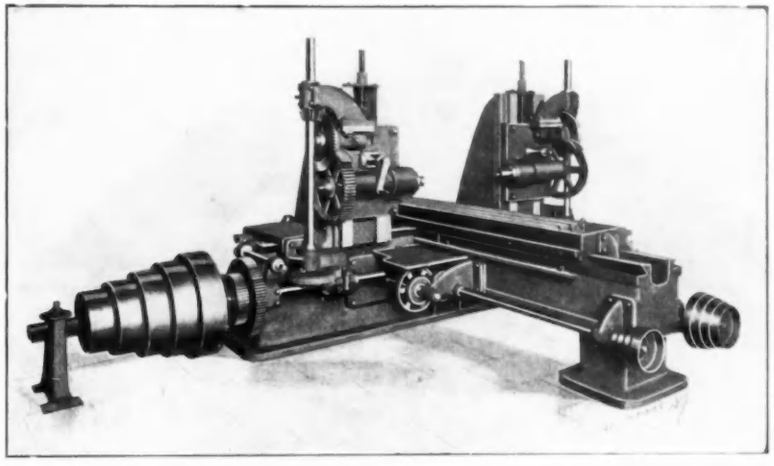
New Free List for Holland.

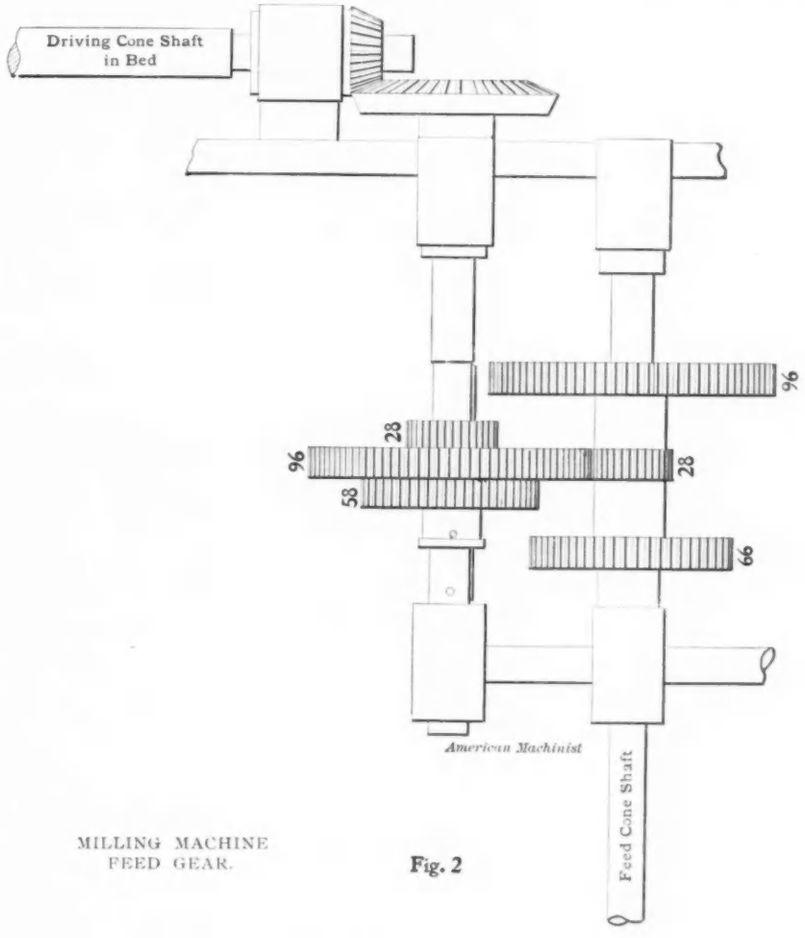
By a recent ministerial order the Government of the Netherlands has placed certain iron and steel articles and machinery on the free list, which will particularly interest certain American manufacturers and exporters. Included in the order are ventilators, exhausters and bellows which are worked by steam, gas, petroleum or electric motor only, and are used in factories, on ships, &c. Ventilators for ordinary ventilating purposes and not worked by the afore-mentioned motive power shall remain subject to the existing duty.

Duplex Milling Machine.

We illustrate with this a milling machine by Beaman & Smith, of Providence, R. I., which is notable for its size, and has as well some features not usually found in this class of tools. The main bed which carries the spindle uprights is in one piece, being made with a gap in the centre for the reception of platen bed. Below this gap the bed is of a very heavy section to compensate for the opening in its top. A common construction is to attach short beds to the side of the platen bed by screws or bolts, giving two vertical joints between the two spindle heads, which this construction obviates. The platen bed is securely fastened in the main bed gap and each end has a box leg support reaching to floor. The platen is moved by a screw by hand or power, and is also provided with a quick movement by power in either direction. Each upright has an independent screw adjustment for the placing of the spindles at a greater or less distance apart. Each spindle head has also a vertical screw movement for adjustment above the platen. The driving power is from a heavy cone pulley geared to the spindle with two ratios of gearing. Each spindle can be run independently, or both together. The feeds are taken direct from the driving shaft, and with a quickly adjusted compounding arrangement, the maximum feed of platen can be maintained regardless of the speed of spindles, thereby obviating a common fault with milling machines, the slowing down of the feed when large cutters are used. This arrangement of feed gear is shown in Fig. 2, in which three pairs of gears will be seen, those on the intermediate shaft being mounted on a common quill, by the adjustment of which endwise the different gears may be brought into action; at the same time the feed cones seen at the end of the machine provide a range of feeds for each pair of gears.



DUPLEX MILLING MACHINE.



MILLING MACHINE FEED GEAR.

Fig. 2

The spindles have a taper hole in their front ends with bolt holes running through their entire length for bolt to secure taper shank arbors, or cutters, and also have a threaded end for face mills. The spindles can be run in either direction for slab or face milling. The machine is provided with a plunger pump for the lubrication of cutters, the lubricant being returned from the platen through piping to a tank which is inclosed in the base.

Following are the general dimensions:

Distance between ends of spindles from 9 inches to 36 inches. Hight of spindle centre above platen from 2 inches to 18 inches. Width of platen on work surface, 16 inches. Length of same, 6 inches. Feeds, at any spindle speed, ½ inch to 10 inches per minute. The driving cone has five sections, and is from 13 inches up to 24 inches diameter for 5-inch belt. Ratio of spindle gearing, 18 to 1 and 70 to 1. Weight of machine and counter complete, about 10 tons.

▲ ▲ ▲

A press dispatch announces, as though is were a matter of considerable importance, that a Syracuse carpenter has dreamed out a scheme of perpetual motion, a problem which up to that time he had not thought about. This, however, is not entirely novel, and the further announcement that the dreamer is now engaged in "perfecting his machine" and allows "only a favored few to see it" has a very familiar sound. One thing is quite certain, however, and that is that the only way to invent a perpetual motion is to do it in a dream, and the man who works upon that problem is dreaming whether he be asleep or awake.

Notes on Rolling Mill Designing.

BY A. RANDOLPH.

ROLL DRIVING PINIONS.

The roll pinions are a very important part of a roll train, but until the last few years very little attention has been given to the designing of proper shaped teeth for them. A great many of those made several years ago had tooth shapes made by some handy rule of the pattern maker, with more regard to convenience than to getting a correct shape. They were generally noisy, failed to give a smooth motion and wore out rapidly.

Some pattern makers laid out cycloidal-shaped teeth, which ran fairly quietly, but they were not very strong, because the base of the tooth was generally too thin. Some attempted to get a stronger tooth by using a small generating circle, but this produced a tooth with a thin point, which was also objectionable.

In the hope of overcoming these troubles the double helical or "herring bone" style of tooth came into use. This was an improvement, because this style of gear can be made to run quietly with almost any shaped tooth used, if the angle of the spiral and width of face are such that the angular advance of the spiral is more than the circular pitch and the tooth has a bearing near the pitch line. These gears will run quietly and give a smooth motion to the rolls, but with the same tooth curves will not be much more durable than straight teeth. Some claim the helical tooth is stronger; but this is very doubtful on pinions of few teeth. I know of a case where helical roll pinions were replaced by a straight tooth gear of equal pitch and face, but with the face divided into three sections, separated by narrow half shrouding, which proved to be much stronger and gave a very smooth motion. With straight teeth the bearing may be across the entire face, but with spiral teeth, unless both tooth contour and spiral are correct, the stress may be concentrated on a limited portion of the face. It is of course obvious that a pattern for a spiral tooth pinion is much more difficult to shape accurately, and for this reason a straight tooth is preferable if there are no serious objections to it.

It may be said that if the pinions are not parallel all the stress may be on one end of a straight tooth, but there is no excuse for lack of alignment, for the bearings of roll pinions are always of a very solid and massive structure, fully equal to the requirements.

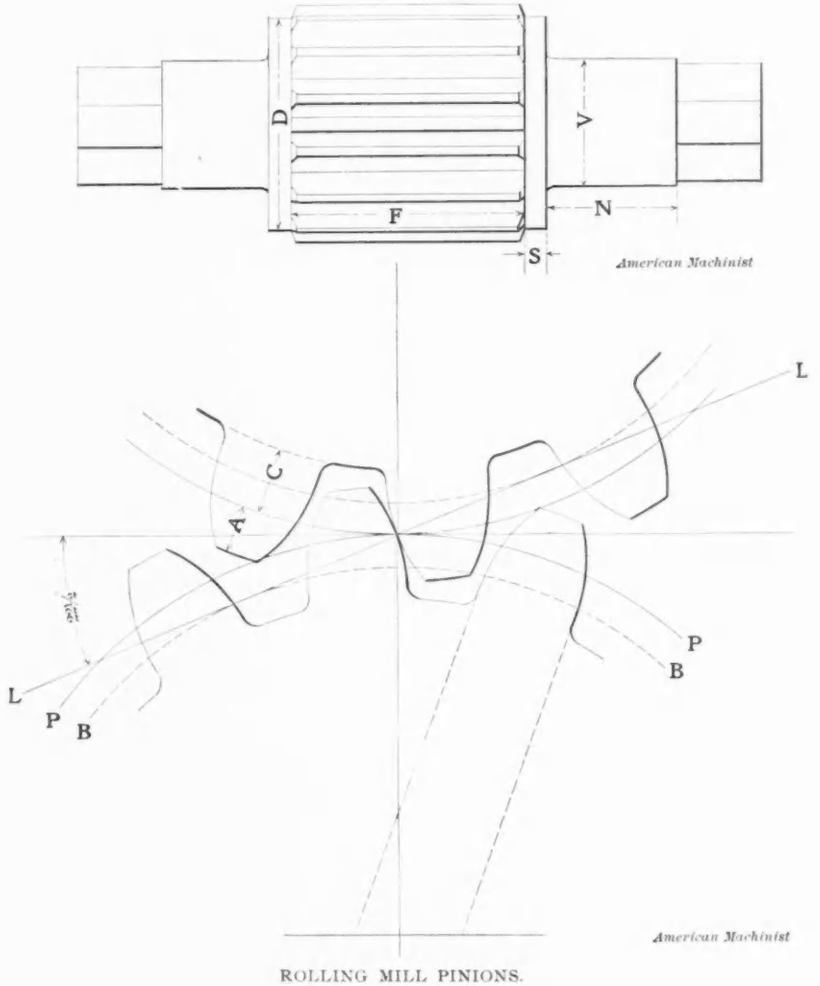
Considering present conditions, I see no sufficient reason for using the spiral tooth, and I do not hesitate to say that, on the whole, the straight tooth is better. As to tooth shape, there is not much doubt that the involute is better than any other now in use. Reuleaux states that in Europe the involute, with a contact angle of 21° to 28°, and length from pitch line to point .22 to .25 of circular pitch, is used. Also that the pinions vary from nine to sixteen teeth. There is no good reason for having less than twelve teeth used for any other purpose, there is no reason for following any particular interchangeable system of laying off teeth, hence the shape should be the one best adapted to the special conditions.

The accompanying drawing shows tooth proportions for pinions having fourteen teeth of the involute curve, generated by a base line at 22½° angle. The length $A = .25 \times$ cir. pitch.

The flank below the base line is parallel as far as the fillet radius, which should be as large as possible and yet clear the tooth corners on the mating wheel. The diameter of base circle $B - B$ is .925 of the diameter of pitch circle $P - P$. The diameter D should be a little less than the pitch diameter, so that the shrouding will not be in contact while running. The face F should be at least equal to the pitch diameter, and is better if made 1.2 to 1.25 of the pitch diameter. S may be one-quarter of the circular pitch. $V = .6$ of pitch diameter, except on sheet and plate mills, which have larger driving spindles, and V should not be less than the spindle diameter. The length N should extend through the bearing enough to prevent the coupling box from rubbing against the brasses.

The tooth curves should be true involutes and not approximate circular arcs, and the pattern should be very accurately made; in fact it would be better if the teeth were machine cut. I think the right way to make them would be to make a metal pattern—a hollow cylinder of a length F, with the teeth milled or planed and the balance of the pattern of wood. The mold should be dry sand, and baked with the metal part of the pattern in place. This would make it possible to have casting so accurate that there would not be the least trouble in getting a quiet running gear, giving a smooth motion to the rolls equal to that of any spiral gear. With patterns so made the face clearance may be 1-16 inch for 1-inch pitch, up to 3-16 for 6-inch pitch, and the bottom clearance ⅛ to 5-16-inch.

Wood patterns are made by hand, and molded in green sand. About double these clearances should be allowed. The shrouding D is to be turned and the ends



ROLLING MILL PINIONS.

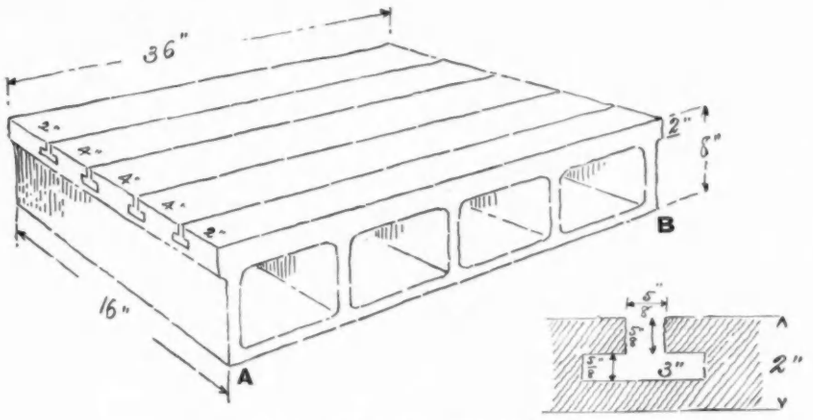


FIG. 1.—A PERSPECTIVE SKETCH.

of the teeth above the shrouding faced to an angle as shown.

In treating this subject I have been obliged to depart from the lines followed in previous articles, because there is not sufficient uniformity of practice to make an average standard from. Therefore I have given methods and proportions which, though they may not be found as a whole in actual practice anywhere, yet nothing has been proposed which is contrary to good mechanical practice.

▲ ▲ ▲

Sketching.

BY W. H. SARGENT.

The art of sketching is often in demand, since there is not always time for careful or finished work, as when making drawings for ordering parts to match; to let a customer know what is proposed or to show that his order is understood; drawings for quotations illustrating the article quoted; drawings for record showing special alterations in machinery or tools; drawings suggesting new ideas when in conference with others. Fig. 1 is a simple illustration of a perspective sketch, the most comprehensive style, but the most difficult, since beginners are usually bothered to understand why lines which they *know* are level in the original should be drawn on an angle, as *A B* in the sketch. The problem of converging lines is often fatal to the rapid use of this style of work; moreover, figures do not attach themselves readily to a perspective drawing, hence it is doubtful if the mechanic will find as ready expression in perspective as in the usual form of projection, as shown in Fig. 2. Paper ruled as in Fig. 3 is helpful in sketching, the ruling being a guide as to direction, while the measurements are made by counting square, a ruling of eight squares to the inch representing inches in a scale of 1½ inch per foot, and 12x12 ruling being useful for plans 1 inch to a foot.

The worst part of a sketch is in making a beginning. The big white surface of the paper frightens one. Here is a suggestion which will help you: Put something at once on the paper—some form having length and breadth resembling the greater proportions of your subject. Draw a center line, an axis, if the nature of the subject will permit, and build your drawing around this. Always look for the greater dimensions first; let the details wait. Thus you will have your paper somewhat covered with lines, and it will cease to stare at you. Possibly this is why it is easier for so many to draw upon ruled paper.

Don't be afraid to feel your way with lines until you reach the correct form. If you get a detail which seems correct leave it until the drawing is complete. It is a common error to draw too large. If you do so rub it out and make it smaller. Don't expect to get all your circles true nor your lines smooth. "Can't even draw a straight line," you say. Very few people can. Don't try it, but make your straight line by a series of short marks, giving your attention to the general direction. Detached sketches should be made of all details or complicated portions, and enough dimensions should be indicated so that the whole may be accurately redrawn at your convenience, much as you would write out your notes of a lecture or a speech. Sketches are a

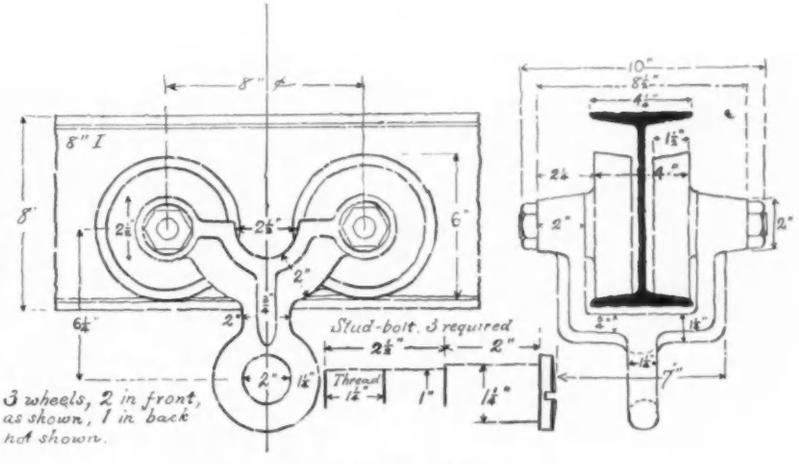


FIG. 2.—SKETCH WITH FULL DETAILS.

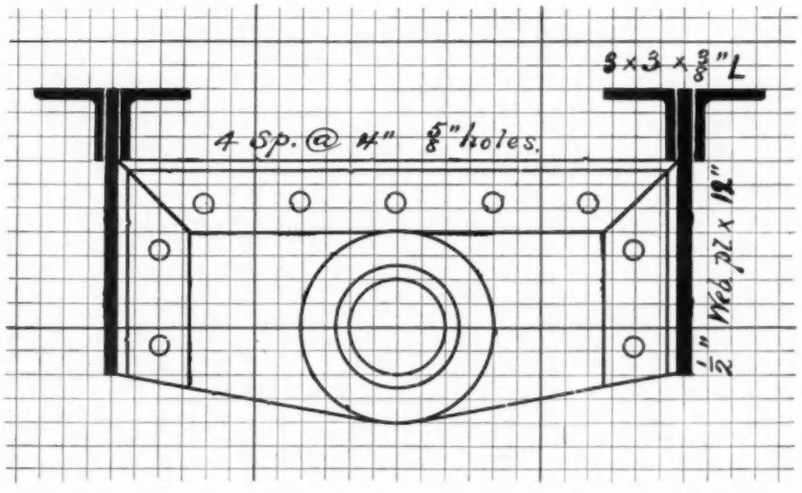


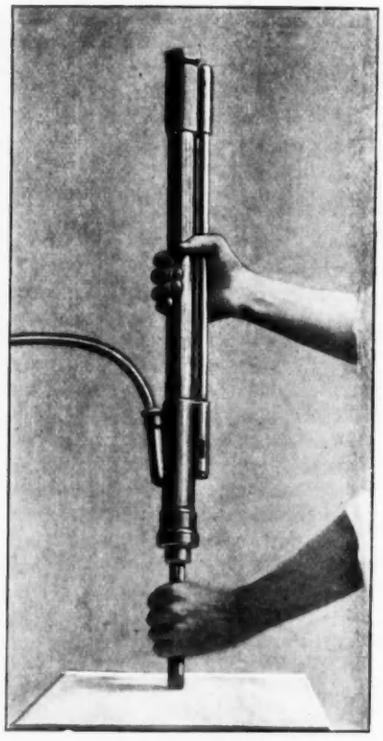
FIG. 3.—SKETCHING TO SCALE.

pictorial shorthand. A good deal of "talk goes with them." All dimensions should be figured and all needed memoranda should be noted. Unfortunately there is no well defined system of abbreviations for mechanical terms, but the more useful ones will suggest themselves. Proficiency in sketching is not obtained except by practice and observation. Students in the art schools practice sketching from casts and models weeks, months, and even years, until the hand is taught to faithfully portray what the eye has learned to see correctly.

▼ ▼ ▼

The Harthan Pneumatic Tool.

The tools of this class which began to appear before the mechanical public a few years ago started out with a very unsatisfactory name. A pneumatic tool may be almost anything that is driven by compressed air. Usually what is meant is a pneumatic hammer, as a substitute for a hand hammer, and in connection with some one or other of the numerous tools which are driven by the hand hammer. The pneumatic tool is therefore used for rock drilling, stone dressing, riveting, calking, chipping, &c., or for simple hammering.



THE HARTHAN PNEUMATIC TOOL.

The present interesting member of its class is shown as a chipping tool, or, in fact, a combined hammer and chisel. In the socket where the chisel is inserted, tools of other shapes, from a center punch up, may of course be used. Probably nine out of ten of the practical mechanics who glance at the half-tone will ask, as the very first question, Where is the throttle? One of the peculiarities of the machine is that it has no throttle. The first air admission and the speed and force of the blows are regulated and controlled entirely by the pressure endwise which the operator puts upon the tool. If there is no pressure there will be no motion; a light pressure will give a light blow, and a heavier pressure will give a heavier blow, as will appear when we come to understand the construction and operation of the tool. It is understood that in all tools of this kind the chisel, or whatever the tool may be, is constantly pressed against the work, and the blows are rapidly showered upon the chisel, or tool, holder. This peculiarity enables it to produce the long, unbroken chips of metal which are sometimes shown.

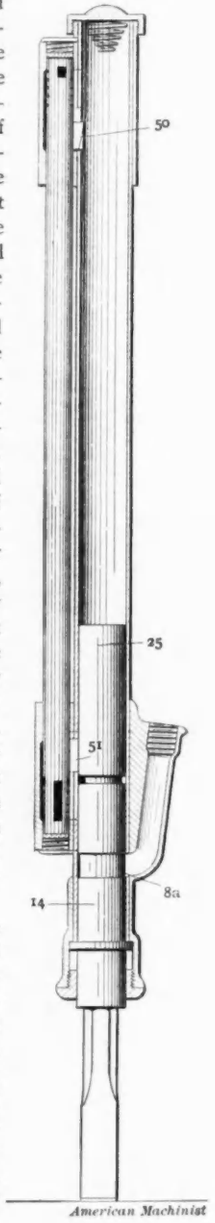


Fig. 2

It may require some little careful study to fully understand the construction and operation of this tool. Referring to Fig. 2, which is a partial longitudinal section, it will be seen that the body of the tool consists of two long tubes, the larger being the hammer cylinder and the smaller the valve cylinder. These tubes are connected at each end by light cast sleeves or jackets. The lower end is shown enlarged in Fig. 3; Fig. 4 is a cross section on the line 6—6 of Fig. 3; Figs. 5 and 6 are vertical or longitudinal sections indicated on Fig. 4 by the lines 7—7 for Fig. 5, and 8—8 for Fig. 6. The bore of the hammer cylinder is parallel for the entire length of it, with ports or other openings cut into it. Inclosed within the hammer cylinder is a sleeve, 14, capable of a limited longitudinal movement, as indicated at 19. This sleeve, shown externally in Fig. 2 and in section in Fig. 3, has a collar which limits its movement. The collar fits the annular chamber in which it moves, and the upper surface of this collar being exposed to air pressure transmitted by the little passage 21 communicating with the main supply pipe, the sleeve is normally pressed downward, although shown in Fig. 3 in the upper position. This sleeve has on the outside of it a contracted section or neck forming an annular chamber, or passage 16. The air passage 11, Fig. 5, communicates at its lower end with the hammer cylinder by means of an opening 12 in the same radial plane as the opening 8_a and communicating at its upper end with the valve cylinder at 13. When the sleeve 14 is clear down this passage is closed, but when it is up the passage is open and air is free to pass to the valve chamber. The sleeve has two internal diameters, the smaller one at the bottom, and in this fits, without binding, the tool shank or socket 23. This may be slipped out of the sleeve at will and any other tool inserted. The top of the shank is flat, and when it is in place its upper end is against the block 24, intermediate between the shank 23 and the hammer 25. When the block 24 is pressed upward by pressing on the tool the little pin 27, which engages the sleeve 14, lifts it and admits the air to the valve.

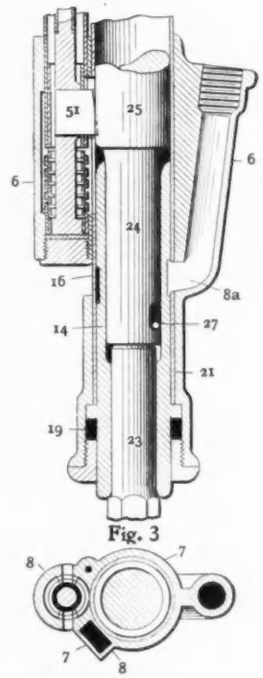


Fig. 3

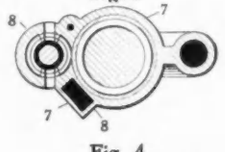


Fig. 4

American Machinist

The working blows are given to the tool by the hammer 25, which is a cylindrical block driven back and forth in the hammer cylinder by the alternate admis-

sion and discharge of the air. The blow of the hammer comes on the intermediate block, and through this to the tool. The lower end of the hammer is reduced in diameter to enable it to pass into the upper end of the movable sleeve. Provision is made for confining a portion of air in the lower end of the cylinder, which serves as a cushion for the hammer, rendering the blow more elastic, and preventing the upsetting or breaking of the striking face.

The valve rod, with the valves on each end of it, has an oscillating motion, as well as a slight movement endwise. The oscillating movement is caused by the hammer, in its strokes up and down the cylinder, alternately striking the tappets 50 and 51, which project a short distance into the cylinder. Their faces do not stand radially, one tappet being at one side of the radial line and the other tappet on the other side of the line, so that the hammer striking them alternately

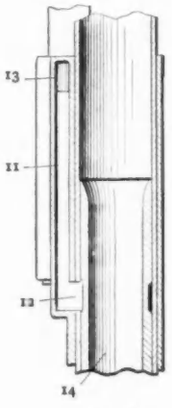


Fig. 5

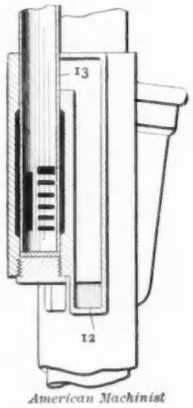


Fig. 6

causes the required oscillation. The end movement of the valves is caused by the alternate admission of the air pressure to one end and then to the other. The arrangement of ports and the valve action in detail is too intricate for us to attempt to fully follow out here.

The hammer in this tool has a much longer stroke than is usual, which enables it to strike a quick, sharp blow and to return gradually, thus avoiding the jar usually experienced. On account of the slight end thrust or vibration, the tool can be used in the most trying positions, high over head, under the feet, or in any nook or corner that can be reached. The instantaneous control of the speed and force of the blow is a valuable feature, as also is the lightness of the tool. The total weight of the one shown in the half-tone, with a head or tool weighing 13¼ pounds and a hammer stroke of 15 inches, is about 8 pounds. It will run with a light pressure of air, 40 to 45 pounds being usually sufficient. The inventor of this tool is Frank E. Harthan, Worcester, Mass.

Molders' Gates.

BY R. D. MOOKE.

Cast iron and other homogeneous metals, even forged iron and steel, break according to a fixed law which is as unvarying as the law of gravity. A correct knowledge of this law applied to the forming of molders' gates would do much toward improving the molders' skill and usefulness. The results of badly shapes gates are to be seen in the blemishes on every casting pile in the land. There are two sources of loss growing out of these defects: the loss of labor and iron in chipping off stumps of gates left on, and the "break in" which blemishes

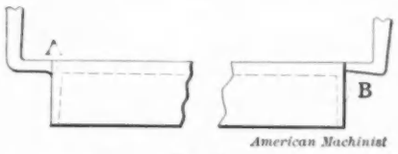


Fig. 1
CORRECT GATING.

a casting which is to be finished, sometimes compelling condemnation.

These hints are founded not on last night's dream, but on long observation. Only a few days ago an anvil block was seen on a truck coming out of one of the largest foundries in one of the Middle State cities with the stump of a large feeder, 4 inches high, to be planed off, somebody's expensive blunder in shaping gates.

A superior French molder, from the

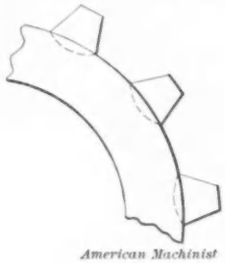


Fig. 2
BREAKING "IN."

good shops in Paris, made a lintel box that illustrates our subject. Fig. 1 gives the two broken off ends of the lintel. One of the important particulars concerning gates is that they should have the proper weakness where they are to be broken off; but the gate *A*, Fig. 1, presents instead the strongest possible shape, just right for a pulley arm where it joins the hub. A filleted arm always "breaks in" when broken close to the hub of a pulley. The dotted line at *A* gives the shape of the "tear in." The other end of the lintel illustrates error in gating. It was made just right for a riser, and for breaking off, but so tapering that as a pouring gate it caved in, as shown in the dotted line *B*.

Having once found in our scrap pile a piece of an iron barrel covered with tits, as shown in Fig. 2, I knocked off several of them. Their shape gave them great strength, but a sharp blow with the point of a riveting hammer, close to the roots, removed them, when they all broke with

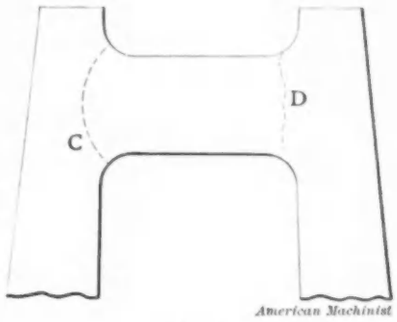


Fig. 3
WHY DOES IT BREAK SO?

the same fracture, tearing out a cavity as shown by the dotted lines; the four sides of the pyramids being strongly tapered gave the highest "tear in" conditions.

Some years ago the "English Mechanic and World of Science," a magazine having a large correspondence from all over the world, had a question sent by a shop hand in a railroad repair shop. He sent a sketch, Fig. 3, stating that many locomotives came to the shop with wrists broken, as shown at *C*, and asked why they all broke with that deep curved fracture, and never with the *shorter*, and apparently easier fracture shown by dotted line *D*. Feeling interested in the subject, I was impressed that it would be a "poser," which induced me to watch for six months, but no answer came. So it appears "the woods are full" of outside thinkers who are as unable to answer this machinist's knotty question as are the "sand engravers," when requested to explain the way the gates break off of their castings.

Fig. 4 presents a plan of a casting,

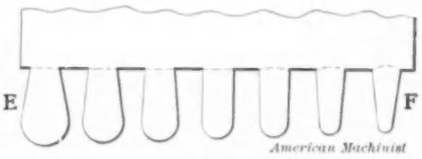


Fig. 4
DIFFERENT SHAPES FOR GATES.

with a row of seven gates attached; they are to be exactly alike in size, say 1 inch square, where they are to break off of the casting, with the bottom lines same as the side lines, giving the shapes shown on three sides, the top of ordinary gates being flat or straight. This row of gates shows a slow gradation in shape from the weakest at *E* to the strongest at *F*, with the dotted lines following very exactly the lines of fracture that will invariably result from such angles, with a

little exaggeration to make them impressive.

These gates are exactly alike in size where they break, and start at exactly the same point, but the course of the fracture is determined by the size, rigidity, or elasticity, *at another point*, or, in other words, by the angle at which that gate takes its departure from that

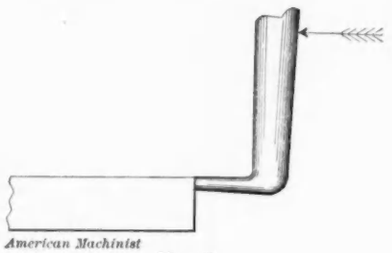


Fig. 5

WHERE TO STRIKE.

breaking point. That strikes one as a strange law, but that law is certainly in force on *our* globe. These lines of fracture, in connection with the shapes given, are easily tested.

Fig. 5 presents an ordinary gate attached to a casting, the arrow indicating the proper point for the hammer blow in breaking it off. This indicates the almost universal practice, but not one in thousands of workmen can give the reason why. A blow at that point puts the tensile strain at the bottom of the sprue, where the breaking point is as distinctly fixed by the shape as by the "notch in a stick." At the top side that point is not so fixed, and it would not break as easily, nor as true, if the blow was given on the opposite side.

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Letters from Practical Men.

A Tool Withdrawing Device.

Editor American Machinist:

In connection with the articles recently published in the "American Machinist" on lathe stops, I would say that I saw in 1874 a threading tool with adjustable and renewable blade, like those now made by many small tool manufacturers, and the stock in which the blade was clamped was provided with means for giving the blade sufficient movement to allow of its being withdrawn automatically from the thread. The operation of the tool was something like this: It was held in the ordinary toolpost and the cross slide adjusted for a chip. Under the head of the binding bolt on the tailstock on the front side of the lathe (the tailstock was the ordinary kind with two binding bolts—one on each side of the tail spindle) was clamped a piece with a slot in it for adjustment, and a hook at one end. As I remember it, this was about 1½ inches wide by 18 inches long and ½ inch thick. The thread tool blade was held in position by a short lever, and the lever by a latch; a spring was connected to the shoe in which the blade was clamped to the stock, and by adjusting the slotted piece held in place by the tailstock binding screw, so that the hook upon its end would trip the latch at the right moment; as soon as the tool arrived at the end of its cut it was automatically withdrawn; then the lathe was reversed and the cross slide adjusted for another chip. The tool blade was moved back to its former position in readiness for another cut by operating the short lever by hand. It was a well made and very convenient tool, and I saw a number of screws very successfully cut with it. The arrangement on the tailstock was only temporary, and used for that time only. In using a lathe stop on the carriage feed great accuracy is desired. I should say the pieces must be very accurately center-reamed for depth. If some were reamed deeper than others upon the end in which the live center was placed it would make a difference in the relation of the stop to the end of the piece. MACHINIST.

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Cracks in Boiler Sheets.

Editor American Machinist:

Some cases of boiler practice that have come under my notice would seem to throw some light on a possible cause of weakness in the boiler, which you speak of in your issue of December 16 as having exploded at Rochester, N. Y. One of these cases was that of a pressure tank, containing air and cold water, about 50 inches diameter, with heads as shown in Fig. 1, and ½ inch thick. The heads were not braced in any way, all seams were double riveted and the workmanship on the job was probably above the average, although not of the best. After being in use about two weeks one of the heads blew out, tearing the solid metal at *a*, Fig. 1, and not at the first row of rivets, where about one-third of the sheet was cut away by the rivet holes. The pressure, as shown by gage shortly before the failure, was about 200 pounds, which would make a tensile stress of about 5,500 pounds per square inch of the fractured section. The fracture at *a* ran around the head from a quarter of an inch to an inch from where the short curvature begins next the shell. The short curve was about 2 inches radius and the heads were machine flanged.

It is, I think, quite generally known, to blacksmiths and others, that if a bar or plate is bent pretty short it is very liable to crack in the bend if straightened out; in fact much more liable to break if straightened than if bent more. In the tank mentioned above the heads bulged out at the center, and this brought a reverse bending strain on the part at *a*, Fig. 1.

It is easy enough to find boiler plate for sale that will stand a tensile strain of 65,000 pounds per square inch, or which may be bent double and hammered down without cracking; but who has ever tested a piece for tensile strength at the point where it has been bent double? Yet in a boiler the plates must be bent and tortured more or less with the sledge before they can hold steam.

In testing specimens of boiler plate it might be well to bend a test specimen to the form shown in Fig. 4, and test it for tensile strength along with the standard straight piece. While any plate is weakened by this bending, the one that is weakened least would seem the most desirable. JOHN D. RIGGS.

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Editor American Machinist:

In your issue of December 16 you have an article on a boiler explosion which took place at Rochester, N. Y. On November 3 a sawmill boiler in this city exploded under exactly similar conditions. I was called as an expert witness on this case, and on making an examination of the remains of the boiler I found a crack over 4 feet long in one of the plates extending nearly through, having not over 1-16 inch of sound metal in the thinnest part.

This crack started about midway between the edge of the rivets and the edge of the lap in a double riveted lap joint longitudinal seam, well up out of the fire and covered by brickwork.

My theory as to the cause of that crack is different from that of the other witnesses on the case, and also from that of Mr. Allen, of the Boiler Insurance Company, and I would like to have an expression of opinion from you or some of your readers.

I inclose two sketches to illustrate my meaning. No. 1 shows a lap joint as usually constructed. No. 2 shows the same joint as it should be, and is made by some boilermakers. My theory is that when internal pressure is applied to the shell it will assume the shape shown in No. 2, unless prevented from doing so by some other force acting against it, which in this case is the resistance of the plate to flexure. With the pressure fluctuating from 75 to 100 pounds, consider that the plate at this point of fracture (see Fig. 1) is subject to a constant bending action, which continues until the crack begins to develop. As years pass on the crack increases in depth, until there is not sufficient strength to withstand the pressure, and the explosion occurs.

I have seen boilers with lap joints constructed as in sketch No. 2, but they are not common in this part of the world, and in my estimation the only proper construction of the longitudinal seams of boilers is the double butt strap. In conclusion, let me say that I am writing this letter for the purpose of getting other

people's opinions on this subject. No stone should be left unturned to make the thousands who work about boilers reasonably sure that when they go to work in the morning they will not be brought back before night in the ambulance mangled out of all resemblance to human beings. GEO. M. TAYLOR.

Vancouver, B. C.

▲ ▲ ▲

Bending Boiler Sheets.

Editor American Machinist:

The article on "Boiler Explosion" in your issue of December 16 contains something new to me; that is, the statement that it is customary to bend the edges of boiler plates with a sledge, also that the method of rolling plates is as described. Such methods would be very crude, compared with using former plates on the bottom rolls. The easiest way to make a former plate is to bend a sheet of iron that is much heavier than the one to be used, passing it through the rolls far enough to have a good hold, then placing the sheet to be rolled on top of it; open the rolls so that it will go in, then pass both sheets through far enough for the top sheet to catch the second roll, then back the top sheet out and reverse it for the other edge. A cast-iron former can be used where there are to be irregular curves, or where there is enough work of the same size to warrant the expense of making it. X. Y. Z.

▲ ▲ ▲

Universal Screw-Cutting Device.

Editor American Machinist:

The universal screw-cutting device, as illustrated in your issue of October 14, is very ingenious and no doubt can be of some use either for correction of the lead-screw, or for cutting odd pitches. But it has its limitations. In the first place it requires a compound rest, and in the second place it will cut only short screws.

The accompanying sketch shows a way to cut screws of any length and of any pitch. I ought to say it shows the principle of a method for accomplishing this. It is obvious that the sketch does not represent a device ready to be put on a lathe. The thing as shown is not practical at all. But the objections that may be raised can be overcome, and anyone who wishes to do so is welcome to use it.

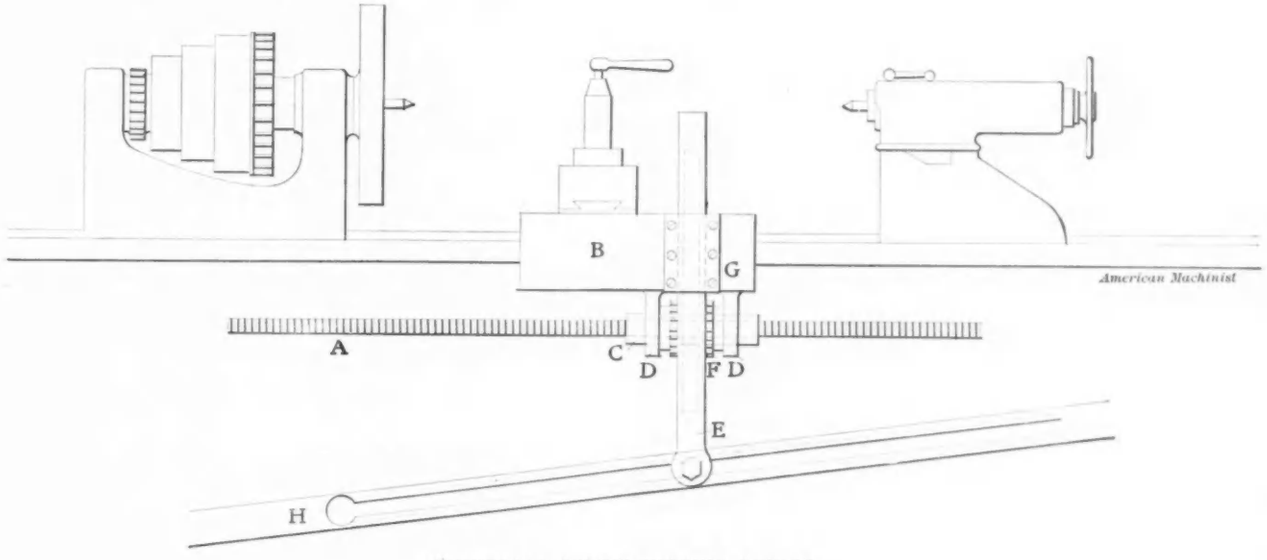
A is the lead-screw, which moves the carriage *B* by means of the nut *C*. This nut is different from the common half nuts. It is cylindrical in shape and revolves in the lugs of *D D*, between which it is held. It is kept from revolving by means of the rack *E*, which engages a pinion *F*, cut on the circumference of the nut. This rack is guided at *G*, and its lower end holds a roller, which moves in the groove of a guide bar *H*. This guide bar may be set at any angle.

The carriage moves when the lead-screw revolves and takes the rack along. As its lower end is guided in the groove, the rack is compelled to move upward or downward, according to the direction of the slant of the groove, and according to the direction of the motion of the carriage. The up or down motion of the rack revolves the nut, and so gives the carriage a differential motion. The pitch of the screw to be cut may be altered by changing the slant of the guide bar.

One of the objections against the arrangement as shown is that the nut cannot be thrown out; another that the vertical rack would have to be of great length; another that the guide bar would have to have a wide range of adjustment, and there are several more. But, as I said before, I do not claim to offer a practical arrangement, but only a principle, which may be applied if one overcomes the difficulties which present themselves. This, however, I am sure can be done if one tries hard enough. If it is worth while to try very hard is another question I do not wish to answer. This, however, I am prepared to say, that the difficulties I mentioned are not as great as they seem at first.

A. L. DE LEEUW.

Hamilton, Ohio.



UNIVERSAL SCREW-CUTTING DEVICE.

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Cooling Water by Re-expanded Air.

Editor American Machinist:

Your correspondent, Mr. R. E. Chandler, in issue of December 30, has failed to produce a cooling effect by the expansion of air, because he appears to have overlooked the fact that expanding air can cool only in the measure in which it delivers energy, and that this energy, if re-converted into heat, will simply restore the heat which in the expanding air has disappeared.

In the attempt of your correspondent the energy developed by the expanding air was absorbed and re-converted into heat in the same apparatus in which he expected a refrigerating effect, and a failure was inevitable.

Success can only be attained by conveying the energy given off by the expanding air to some distant point where it may be re-converted into heat, or consumed in some other way. The most rational method consists in allowing the expanding air to assist in the work of compression, thus reducing the expenditure of power required in a continuous process. This, of course, requires two cylinders and pistons, one for compression, and one for expansion.

HUGO BILGRAM.

Philadelphia.

[We do not see clearly how compressed

air can expand to a larger volume and a lower pressure without doing work or delivering energy. The work may be done in pushing a piston, or by the air merely pushing its way into the surrounding atmosphere, but with the expansion in either case will come the fall in temperature. The "freezing up" of machinery driven by compressed air is a familiar experience. It happens that this freezing may and does occur when the air in the cylinder actually does no mechanical work. Perhaps the worst cases of freezing up are found where air is employed for driving steam pumps, and where the air follows the piston at full pressure for the full stroke. The air in the cylinder in this case certainly does no work. The work is done at the compressor, and the air is simply driven along, as an iron bar might be driven along, by what is behind it. In the case of steam used in the same way to drive the pump, and with no expansion in the cylinder during the driving, the work would be all boiler work. Yet it is an indisputable fact that with air used in this way, and with a cylinder full of air at full pressure at the end of the stroke, and after the work of the stroke is done, and with the air at practically normal temperature up to this point, there is a great and sudden fall of temperature the moment the air is released, and in consequence of its release and expansion. A partial expansion occurs in the cylinder, and it is cooled more or less. Such cylinders under these conditions are often seen covered with frost. The further and final expansion of the air in the exhaust ports and pipes freezes them up worse than the cylinder. It is, as our correspondent suggests, quite customary, where air is to be systematically employed for refrigeration, to use it expansively against a piston connected with the compressing apparatus, and quite a saving of power is effected by the arrangement, but a fall in temperature necessarily accompanies the expansion of the air whether it is employed to drive a piston or not.—Ed.]

▲ ▲ ▲

Compressed Air Explosions.

Editor American Machinist:

In your issue of December 30, under the title of "Compressed Air Explosions," I find some statements as to the impossibility of explosions, which my experience leads me to believe should be modified. It was my fortune during the summer of 1896 to witness no less than three serious explosions of a mixture of oil and compressed air. The first one occurred before we knew how much oil really came from the compressor with the air in the course of a day; so may be put down to ignorance as a cause. The second, which took place at the bottom of a car pit, temporarily covered, was hidden at the instant of explosion. For the succeeding few seconds we were all too busy dodging trapdoors and parts of machines with which the atmosphere was filled to take accurate observations; so the cause remained a mystery until the third explosion, which took place under the following conditions:

A tank was about to be charged with compressed air from a large sectional reservoir for the purpose of testing a new charging valve. The usual working pressure was something over 2,000 pounds, but since the air in the main reservoir had not been replenished for a couple of days, this had fallen by leakage and use to about 1,700 pounds per square inch.

The reservoir was in a building at a distance of about 100 yards from the laboratory in which the explosion took place, and was connected with the experimental department by means of a steel tube laid underground. At the end of this tube, within the laboratory, was a high pressure angle valve similar to an ordinary globe valve. From this valve a steel pipe descended vertically about 4 feet and thence extended along the floor for 20 feet, where it entered a fitting containing a universal joint. Thence a pipe was carried upward to the charging valve first mentioned, which was being tested. The charging valve could be moved about on the end of its pipe by reason of the universal joint. It had just come from the shop, had been attached to the end of the charging pipe, from which the air had previously been shut off by means of the angle valve, and had then been coupled to the tank which was to be charged.

It must be borne in mind that the pipe joining the two valves consisted of two short vertical pieces connected at their lower ends by a long horizontal one. These pipes I had seen tested to a pressure of 6,000 pounds per square inch, and they had been in daily use under an air pressure of over 2,000 pounds.

Everything being ready for the test, a man was told to throw over the lever which opened the charging valve, but he, remarking that the air had not been let into the charging pipe, proceeded to open the angle valve where the main pipe entered the building. A frightful explosion occurred at the moment of opening this angle valve. It was much louder than the air explosions which I had previously heard, being sharper and more deafening in character. It was, moreover, accompanied by a great burst of flame, which, together with the concussion, left one dazed for a minute or more. Fortunately no one was injured.

Upon investigation I found that a portion about 3 feet long had been torn out of that end of the horizontal pipe nearest the universal joint. The piece, which was about an inch wide, had broken into two smaller sections, one of which had gone entirely through a 2-inch spruce plank, and the other was sticking up like a sword blade from the heavy floor which it had penetrated. The universal joint was wrecked. One piece of it, a plug 2 inches in diameter by the same hight, had gone through the floor and 8 inches into the tightly packed earth below. The pipes and fragments, as well as the floor near the rupture, were coated with a fine dust-like deposit of soot. An odor of oil was noticed, but that always attends an air explosion. The effects of the explosion extended no farther. Both valves and vertical pipes were intact, as well as more than three-quarters of the horizontal portion.

Now, in my opinion, this explosion could have been caused in only one way, and that by the firing of a mixture of oil vapor or spray mixed with air. First, as to the oil. While it is true that no great amount of oil comes away from a good compressor with the air, it is also true that a small portion is carried off as spray and a still smaller amount as vapor. After a time, as this oil is driven along the delivery pipes, it settles into such corners or pockets as it can find, and where a pipe drops to a lower level, from which it afterward rises, a very pretty trap is formed, as in the case under consideration. Some of the first reservoirs with which I experimented were placed horizontally with the inlet and outlet pipes at the center of their heads. I knew that moisture would condense in the reservoirs, but thought it would evaporate when the air was withdrawn. They were, however, soon found to be half full of water, with a thin film of oil on top, which prevented evaporation most effectually.

Our compressors were as nearly perfect as such things can be, one being a three and the other a four stage machine, with plenty of cooling surface and ample supply of water thereto.

Finally, for the direct cause of the explosion. We had two closed valves connected by a loop of pipe containing oil and air at atmospheric pressure. One valve is opened, letting high pressure cool air into the space. The incoming air stirs up the oil, catches it in the narrow pipe and drives it like a plunger down the tube. The air originally contained in the pipe is compressed by the incoming air just as if it were being acted upon by a piston. Its temperature is almost instantly raised to that corresponding to a red heat, or above. The small amount of oil present is vaporized and fired as prettily as though Messrs. Hornsby & Ackroyd had superintended the performance. The man who survives the experiment will wonder why he ever put compressed air through a coil of pipe heated in a fire, and will congratulate himself that he did not, like some early

experimenters, pass it through a mass of burning coke or charcoal in a tight receptacle. WM. E. GIBBS.

New York.

[The narrative of practical experience here presented is one which our readers will welcome. The letter of our correspondent enforces by practical examples the necessity of avoiding high temperatures in connection with compressed air, or in the air itself. The enforcement of this lesson was the purpose of the previous article to which the writer refers. When attention is thus sufficiently called to the dangerous conditions it is not difficult to avoid them. The suggestion in the last paragraph of the letter as to the danger of re-heating compressed air is commended to the serious consideration of those who are advocating the direct application of fire for that purpose.—ED.]

▲ ▲ ▲

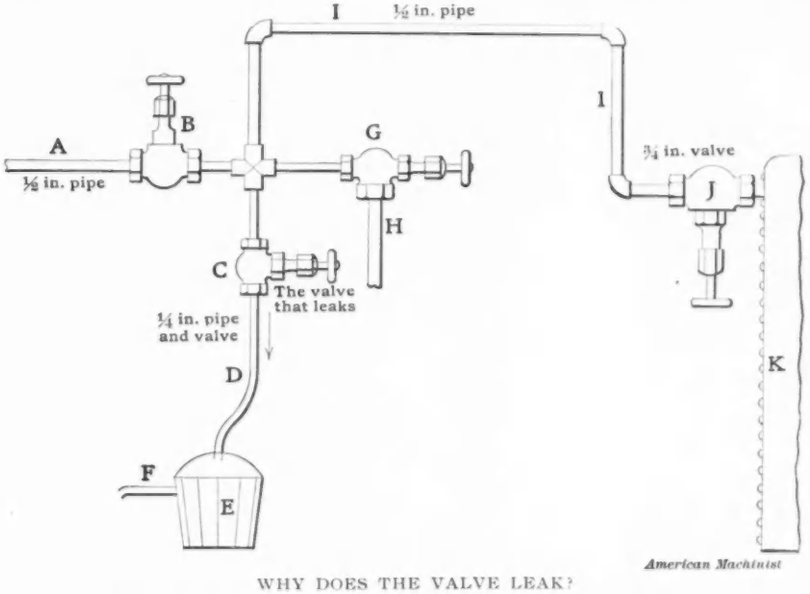
Why Does the Valve Leak?

Editor American Machinist:

I send you a drawing of some of the piping in my shop. Some of the time I use steam to run my engine, etc., from the 60 horse-power boiler of the grist mill, and some of the time from my own boiler. In the drawing *A* is the pipe leading from the mill boiler; the pipe is ½ inch and about 25 feet long. *B* is the valve to shut the steam off their boiler; *J* shuts the steam off my boiler. When I put the piping in I put in a ¼-inch pipe and valve to drain the pipe of water, but all this summer it has leaked enough to free the pipe from water. When I use their steam it leaks all the water out of the pipe, also quite a lot of steam; but when the steam is shut off their boiler and turned on from my boiler it does not leak hardly a drop. There is where the question arises. Why does it leak when steam is turned on from their boiler and not leak with steam turned on from my boilers. The pressure is the same on both boilers, about 80 pounds. I have asked several engineers here their opinion why the valve should leak under steam from one boiler and not from the other. The steam strikes the valve the same from both boilers. There must be a cause for it, but I cannot say that I know the cause. I have a curiosity to know what the cause is, and if you can give any reason for it I would be pleased to know. I never heard of a similar instance before, but some of the readers of "The American Machinist" may.

HARRY C. DAVENPORT.

Blissfield, Mich.



WHY DOES THE VALVE LEAK?

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Roots by Logarithms Having Negative Characteristics.

Editor American Machinist:

Referring to question No. 181 in your issue of December 23, there is another way of solving the problem, which, it seems to me, is easier to grasp and to remember than the way you give. It is based on this principle: When operations of multiplication or division are to be performed on logarithms with negative characteristics, treat the characteristic and the desimal part as two separate quantities, giving the former a minus and the latter a plus sign, and perform the operations on each part separately. If the result of the operations brings a desimal part with a minus sign, subtract it from 1 and add minus 1 to the characteristic.

Thus, $\sqrt[3.42]{.555}$.

Log. 555 = T. 744293 = —1÷.744293.

Divide by 3.42.

From a table of reciprocals — 1 ÷ 3.42 = —.292398.

.744293 ÷ 342 = ×.217629.

Adding = — .074769.

Changing to positive decimal part T .925231, which is the log of O. 84184.

New York. WM. KENT.

A Cast Iron Chip.

Editor American Machinist:

I send you a chip which was turned in our shop (Shaw Electric Crane Company) from an 18-inch or a 24-inch chain drum. This chip was made in taking a finishing cut with the tool, tracing of which is also inclosed, and is about 1⅜ inches wide.

This tool is an old one and the toolmaker does not feel sure as to the steel.

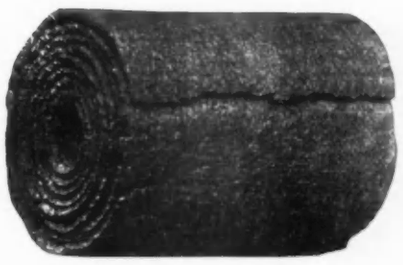
Mr. E. J. Sherwin, who furnishes us with castings, says that for chain drums he uses the following mixture:

Hinkle charcoal iron, 30 per cent.

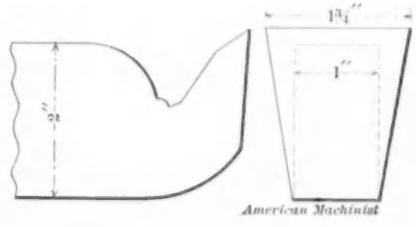
Cherry Valley, No. 2 Foundry, 50 per cent.

Machinery scrap, 20 per cent.

The drums are cast in dry sand and remain in the mold all night, and sometimes part of the next day, before any attempt is made to move them. They are cast on end.



A CAST-IRON CHIP.



THE FINISHING TOOL THAT MADE THE CHIP.

The drums are from 18 inches to 33 inches diameter, and are cored out so that the walls are from 1⅜ inches to 2¼ inches in thickness, which of course varies with the load they are to have, and they are ribbed around the inside. The lathe used in turning and grooving them is of Pond Machine Tool Company's make. The cutting speed used on both roughing, finishing and grooving is about 14 to 18 feet per minute without crowding the machine.

The chip sent you was from the finishing or smoothing cut. Sometimes these chips roll up even larger than that sent you, which is a good average specimen.

A. DENISON WILLIAMS.

Muskegon, Mich.

AMERICAN MACHINIST

Published Thursdays by

American Machinist Publishing Co.,

256 Broadway, New York.

JOHN A. HILL, President and Treasurer.

C. A. HANSMANN, Sec'y.

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Subscription Price:

$3.00 a year in advance, postage prepaid in the United States, Canada and Mexico.

$4.00 a year to other countries, postage prepaid.

Entered at Post Office, New York, as second-class mail matter.

For Sale by Newsdealers, Everywhere.

No back numbers beyond 1897.

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Labor Saving Machinery.—A Proposed Boycott.

To judge from most of the comments on the English engineering trades' strike that reach us one would inevitably conclude that the only men in Great Britain who stand in the way of the introduction and use of improved labor-saving machinery are the workmen. We have previously pointed out the error of such a conclusion, and the fact that what we regard as British conservatism is by no means confined to a single class of men there, but pervades all classes, with of course an occasional exception in all of them.

This view of the matter is sustained by the position taken by the great shipbuilding firm of Harland & Wolff, at Belfast. This firm has declined to take part in the concerted movement of employers against the men, and W. J. Pirrie, who is at the head of the firm and who is also Lord Mayor of Dublin, criticised at a public dinner recently the tendency of employers to think that the labor troubles of today could be settled by recourse to coercive methods which might have done well enough fifty years ago, but which were utterly useless at this end of the century. He advised the adoption of the latest and most improved machinery as the best means of coping with foreign rivalry, and asserted that this would be more efficacious than an insistence on low wages and long hours. The refusal of the other English shipbuilders to acquiesce in these views, declared Mr. Pirrie, was the reason why his own firm had refused to co-operate with them in the present troubles.

Another feature of the case which may be not without interest is that other British shipbuilding firms are advocating a general boycott of Harland & Wolff, and some of them are reported to have announced that no maker of shipbuilding materials who accepts orders from Harland & Wolff can expect to receive orders from those who propose the boycott. If such a boycott is imposed there will probably be some demand in Belfast for American shipbuilding materials, and there can be little doubt but that orders from there would be promptly filled.

When a number of firms join together to fight for what they conceive to be rights vital to the continuance of their business; when such a fight involves very heavy losses for them, and they see another firm avoiding these losses and taking their own business away from them by refusing to take part in the fight, they knowing at the same time that if the fight, thus materially weakened, is won by them, the non-participating firm will inevitably reap the full benefit of the victory also, it is nothing more than natural that they should feel strongly and very bitterly about it.

But the point we wisn to call attention to particularly is that this incident is another illustration of the fact we have always insisted upon—viz., that human nature, whether it be found in workshops or in the offices connected therewith, is the same old human nature—has the same good points and the same weaknesses, and is influenced by much the same motives. For are not these British shipbuilders proposing to do precisely the same thing as is done by organizations of the men everywhere in their treatment of "scabs?"

Both say to those who refuse to join with them in their fighting: "Fight with us or against us. If you do not help us in our fight for what we consider to be your interests as well as our own, we will drive you out of business."

Whether we condemn or whether we approve the principle involved in this action, let us not make fish of one and fowl of another; nor forget that what is sauce for the goose is also sauce for the gander.

Department Stores.

The cable tells us that the shopkeepers of London are up in arms because the Prince of Wales visited a large department store and made several purchases, thus giving to this system of doing business the influential indorsement of royalty.

In this country we also hear of much opposition to department stores, and attempts have been and are being made to secure the enactment of restrictive legislation applying to their business.

We sincerely hope that no machinist takes part in or sympathizes with any movement against such stores. The business of the machinist depends entirely upon the disposition of people to introduce improved means of accomplishing useful work, *i. e.*, means by which things that human beings desire can be placed in their hands at a constantly decreasing cost. This is not of course the prime or fundamental object of the machine builder, but it is rather the effect produced by his efforts to make a living.

It is precisely the same with the department store. It can succeed only by introducing economies in commercial methods which enable it to undersell other stores. By its existence those machinists who are fortunate enough to have access to it can reap the benefit of economies in commercial methods which are in some degree commensurate with the economies that manufacturers have been forced by competition to adopt.

The fact is that competitive manufacturing in this country is, and has been for some time, little else but a constant strife to save here and there a few cents, or a fraction of a cent, in cost of production, and, broadly speaking, there has been no comparable lessening of the cost of distribution and of selling.

To attempt to legislate against department stores, which are succeeding only because, by their methods of conducting business, they can undersell smaller stores pursuing the old methods, is precisely the same in principle as to attempt to legislate against the use of improved labor-saving machinery. Both are foolish and futile.

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Anouncements of the formation of trusts are multiplied in these days; we have wire trusts, bridge trusts, milk trusts and wood-working machinery trusts, and several other varieties the names of which do not at present occur to us. Along with these rumors comes one to the effect that the typewriter trust, which has seemed to be doing fairly well for the past few years, is about to break down, and in connection with that it is declared that American-made typewriting machines have been sold freely in foreign lands at about half the price asked for them here at home. Manufacturers

may excuse this method of doing business as much as they choose, but it is a hard fact that the people of this country will always set their faces against any system by which they are made to pay two or more times the price paid by a foreigner for the same American product. The prejudice against the unfair treatment of American buyers is of itself sufficient to stimulate vigorous competition, and such competition will in the end make it impossible to maintain the organization responsible for it.

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"Sympathetic outreach" is the latest invention of the renowned Keely, and he announces that he has discovered something which neutralizes the effects of gravity. There is, perhaps, great danger in this, because if Keely should build a sufficiently large apparatus so that he could entirely do away with the force of gravitation, the motions of our solar system might be very seriously disturbed. There is one consolation, however, in view of the fact that if Keely pursues his usual course he will not put this new machine into practical use before he abandons it for some other startling discovery.

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We have previously referred to the opposition of Scotch joiners to the use of ready-made joinery imported from this country, and it is interesting to note that the Scotch workmen claim as a justification for their opposition to this American machine-made joinery that the men who make it here receive much less wages than they themselves are getting.

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Mr. C. S. Mallett, assistant superintendent of the Canadian General Electric Company, Peterboro, Ont., writes us in relation to press fits that he finds for diameters of from 4 inches to 8 inches. About .001 inch to the inch of diameter gives a pressure of about 40 to 50 tons with cast-iron hub and machine steel shafts, the length of the hubs being about 2½ to 3 diameters.

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Questions and Answers.

Name and address of writer must accompany every question. Questions must pertain to our specialties and be of general interest. We cannot undertake to answer questions by mail.

(1.) G. E. T., New Britain, Conn., asks: Would it require as much steam to run an engine with the main belt slipping as it would if the belt did not slip? A.—This question calls for various answers, or an answer with various qualifications, on account of the different conditions under which slippage may occur. Suppose an engine to be running at a uniform speed controlled by a governor, and driving a line shaft by a belt with just sufficient strength or tension to drive without slipping. If slipping occurred it would be either from an increase of load on the line shaft or from a decrease in the tension or adhesion of the belt. In either case the speed of the driven shaft would be reduced. The power imparted by the engine is determined by the unbalanced pull of the belt, or the difference between the tension of the two sides. It is generally true that as soon as a belt begins to slip the adhesive friction is reduced, and consequently the unbalanced pull upon the engine wheel and the steam required to drive it would be reduced. If the belt were not, as we assumed at the beginning, doing all that it could do, then an increase of load to the slipping point might leave the belt, save when slipping, with a greater unbalanced pull than when running with normal load, and in that case the steam required would be increased. If, with constant load and uniform driving speed, slippage occurred on account of the weakening of the belt the steam required would of course be reduced in proportion to the decreased belt pull. If we suppose a case in which the driven shaft ran at a uniform speed and constant load, while the engine ran at an increased speed on account of belt slippage, the steam required would be increased. The amount of power, or the foot-pounds, transmitted to the driven pulley in any given time will be the unbalanced pull of the belt in pounds multiplied by the number of feet traveled by the periphery of the driven pulley. The power exerted by the engine will be measured by the same unbalanced pull of the belt multiplied by the number of feet traveled by the periphery of the engine pulley. Of course if there is slip the peripheral speed of the engine pulley will be greater than that of the driven pulley, and the power exerted by the engine, or the steam required, will be greater in proportion to the difference in the peripheral speeds. It not only requires power to drive the driven pulley, but power in addition to this is required to cause the slippage. Slipping belts must always mean power lost.

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American Machine Trade in Europe.

Editor American Machinist:

I am many times asked, "Will the demand for American tools in Europe be permanent?" and in reply would say, "It shows no signs of falling off in any country which I have visited. The trade in Germany goes on with mighty strides. The electrical development there is enormous, the large builders having advance orders of many millions."

We are congratulating ourselves on dividends of 12 and 15 per cent., while many of the large German manufacturing companies are paying all the way from 25 to 40 per cent. each year. The A. Borsig Company, of Berlin, has about completed what is claimed to be the largest locomotive works in the world.

Ludwig Loewe & Co., of the same city, will shortly move into their mammoth works for the manufacture of machine tools. American superintendents, foremen, draftsmen, &c., are in steady demand in Europe at liberal advances over rates paid in this country. All these parties have been large buyers of American tools, and will no doubt buy many more.

Our company has exported during the past year over $500,000 worth, the largest part of which has gone to Germany. Had our facilities been greater we could have largely exceeded that figure.

We have lately purchased a new plant and see our way clear to increase our business about 60 per cent. over last year. We are thoroughly organized in Europe, having our own offices in London, Paris, Berlin and Vienna. Without having the statistics at hand, it may be safely stated that Germany supplies Russia with more iron and steel products than all other nations combined. The Americans will have to use all their Yankee ingenuity, skill and enterprise to hold their own for the future with Germany in the markets of the world. There is a remarkable development going on in Russia, and will no doubt continue for years. The Government absorbs the entire output of the machine shops, locomotive and car works, leaving the other demand to be supplied by outside countries.

The engineers' strike in England is rapidly drawing to a close, with a victory in sight for the masters. Public sympathy has not been with the strikers, and it is now decidedly against them, as it is believed that England has lost many millions by the strike, driving trade to other countries.

The trade of France is good and is increasing, the Government having been a large buyer of American tools during the past year. The large manufacturing concerns in France are now taking hold eagerly.

Belgium has been a good customer for tools during the past two years. Some of her large works have lately secured important concessions for railroads in China. All this material will be built in Belgium, and should demand more American machinery.

Business in Austria has received a setback by the recent political agitation there. This is believed to be temporary, and business there will no doubt soon resume its normal proportions.

Business in Holland, Denmark, Sweden and Norway has been steady. The number of new enterprises starting in these countries has not been equal to those started in the others mentioned above. This may account in some measure for a lack of speculative demand.

The machine tool builders of the United States have cause to be proud of the scope and influence of the "American Machinist" in Europe. I cannot recall any manufacturing concern or dealer of any prominence that did not have it on file in a convenient place.

I want to go on record as stating, without any solicitation, and without fear of contradiction, by one of the many tool builders that have been to Europe, that the influence of the "Machinist," combined with the letters written by Mr. Miller, has brought the attention of Europe to American built machine tools more than all other influences combined.

Mr. Miller seems to have accomplished

the seemingly impossible task of "pleasing both sides." He pointed out their shortcomings in such a diplomatic manner that they hastened to correct themselves by buying American tools.

I heard favorable comment upon his letters all the way from London to St. Petersburg.

In closing I would suggest that the "Machinist" take up other lines of machinery that can be placed in Europe. Let it enter upon an active, aggressive campaign to induce manufacturers in all lines to investigate the European markets. They in turn may meet the signal success that has crowned the efforts of the machine tool builders. When all mechanical lines in the United States have found a market in foreign lands, there will be no more overproduction; panics and trade depressions will become things of the past, and a new era of permanent prosperity will dawn upon the United States.

CHAS. DAVIS,
President Davis & Egan M. T. Co.

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Death of James Platt.

Mr. James Platt, the head of the firm of Fielding & Platt, Limited, the well-known hydraulic machine tool builders, died suddenly December 29 at Gloucester, England.

Mr. Platt was a member of the Council of the Institution of Mechanical Engineers, member of the Institution of Civil Engineers, and also of the Iron and Steel Institute. He was vice-chairman of the Board of Directors of the Gloucester Railway, Carriage & Wagon Company. Having made several protracted visits to this country, he leaves many friends here to mourn his loss.

James Platt was born in Manchester, England, on February 4, 1834. He was educated and served his apprenticeship in Sowerby Bridge, Yorkshire, where his father, Mr. John Platt, was the engineer and manager of the, at that time, celebrated tool builders Francis Berry & Sons. When about twenty-four years of age he left their works and became manager of a general engineering works in Gloucester. About this time he designed and built several blast furnace plants, some of the first in England to be equipped with the modern hot blast stoves; he also put in a number of large pumping plants in the Forest of Dean.

In 1866 he founded the firm of Fielding & Platt, and worked this business up until they now employ over 450 men. In 1873 he took out, with Mr. R. H. Tweddell, the first patent on a hydraulic riveting machine. This was followed by many more, and since that date he has been very closely identified with the development of hydraulic machine tools. It was he who saw the need of making riveting and flanging machines of heavy power to enable boilers to be built to stand the heavy pressure then coming into use. It was this foresight which enabled his firm to equip three-fourths of the marine and locomotive shops in England and on the Continent with their hydraulic system. His most important plant in this country is that of the hydraulic tools at the Juniata shops of the Pennsylvania Railroad at Altoona. The last large piece of work he conceived and designed was the building of the gigantic gantry, superstructure and riveting plant for Harland & Wolff, of Belfast, now being used for the building of the large White Star steamship "Oceanic." With this plant practically every rivet in the ship will be put in by hydraulic power.

Mr. Platt always took an active part in the work of the English engineering institutions and was a regular attendant at their meetings. He visited this country with the Iron and Steel Institute. He took an active interest in local politics, and was a Liberal. He was Mayor of the ancient city of Gloucester for two terms, was for twenty years a Town Councillor and Alderman, was a Justice of Peace and also held numerous other local offices. Mr. Platt leaves a widow, five sons and a daughter. His eldest son, Mr. John Platt, is now resident in New York.

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Seth D. Tripp, who was the inventor of very many important improvements in shoe manufacturing machinery, died at his home in Lynn, Mass., on the 7th inst. at the age of seventy-two years. Mr. Tripp began inventing shoe machinery at the age of twenty years, his first invention being a machine for pegging shoes, which work had previously been done exclusively by hand, and from that he has gone on to inventions which have revolutionized shoe manufacturing methods.

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Technical Books.

MACHINE DESIGN. Part I., Kinematics. By Forrest R. Jones, 158 6 x 9-inch pages and 134 illustrations. Wiley & Sons; price $1.50.

The nearest existing book to this in scope is the "Principles of Mechanism," by Willis, although the treatment here followed is of course much more modern and more practical. The book is very compact and the constructions discussed are limited to those in every-day use—mechanisms which are of academic interest, or of occasional use only, being passed over. At the same time frequent references are made to fuller sources of information regarding devices and methods which are here treated only in outline or not at all, and we will be pardoned for noting that our own columns appear frequently in the references.

Not much that is really new will be found in these pages, which are rather a treatise covering familiar ground and collecting together methods and solutions to problems which have been published from time to time by various authors. Mathematics is used where necessary, but not to an embarrassing extent.

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Personal.

Assistant Engineer A. Hartrath, U. S. N., has been detached from Mare Island Navy Yard and ordered to the Mohican.

Mr. Geo. H. Sampson, of the Rand Drill Company, New York, returned a few days ago from a business trip to South Africa.

Passed Assistant Engineer H. G. Leopold, U. S. N., has been detached from the New York Navy Yary and ordered to the Mare Island Navy Yard.

Mr. H. B. Bartlett, of Hartford, sailed on the "Palatia," January 1, for Hamburg, taking his family with him to Berlin, where he will be in charge of the small tool department of Ludw. Loewe & Co.

Mr. R. C. Stiefel, formerly superintendent of the Ellwood Weldless Tube Company, Ellwood City, Pa., has been appointed general mechanical engineer of the Shelby Steel Tube Company, with head offices at Shelby, Ohio.

Mr. A. Brotherhood, of Manning, Maxwell & Moore, who for several months past has been traveling in Europe on business, returned home on the 7th inst., and is strongly impressed with the prospects for foreign business in machine tools.

Warren E. Willis, an occasional contributor to our columns, formerly manager of the American Tool Company, and more recently acting as mechanical engineer with the McKay Metallic Fastening Association, has accepted a position as superintendent for the Fox Machine Company, of Grand Rapids, Mich.

Messrs. A. H. Newcomb and H. H. Carter, American tool-makers, who, something more than a year ago, went to England in seach of experience and to manage automatic machinery, have returned to America, and are very decidedly of the opinion that conditions here are much more favorable for skilled and ambitious mechanics.

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Inquiries for Machinery.

Those who make, or who may know of the makers of such machinery as is called for below, will oblige us by sending name and address, mentioning the number of the inquiry. We cannot forward catalogs. We have inquiries as follows:

20. For a machine for making chains with twisted links, such as are used on machine tools for suspending counterbalance weights.

21. For a small cotter drill for milling key seats in shafts from 1 inch to 2 inches in diameter.

The Longer Work Day.

The Massachusetts Legislature, to assemble next month, will be asked by the representatives of the largest manufacturing industry in the State to repeal the factory restriction laws relating to the hours of labor. There is nothing in the industrial position of the times to justify such a course. It is still true, as it was in the beginning, that men must earn their bread in the sweat of the face; but it is also true that man has achieved a mastery of natural forces never before known, and that he has attained the power to satisfy the wants of his physical being with a less and less expenditure of labor.

This fact is reflected in the laws of Massachusetts restricting the hours of factory labor, and which are in course of adoption in nearly all highly developed industrial communities. Their repeal might well be asked had some great catastrophe overtaken the labor of the world and compelled the expenditure of extra effort to recover the lost ground; but when based upon the fact of an overproduction of commodities it becomes an appeal that the bars be let down to a mighty, gratuitous and wasteful contest of capitalists in producing what is already

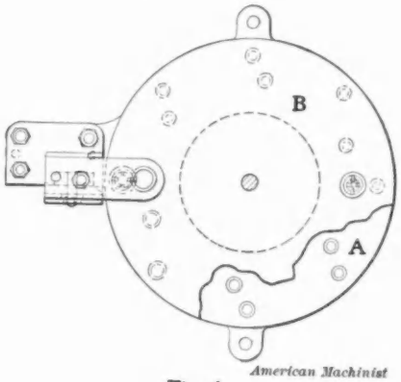

Fig. 1

in overabundance, and in grinding the face of labor more closely in order to do it. It is the suggestion of wantonness or despair. The Massachusetts standard cannot wisely be lowered to that of other States; rather must that of other States be brought up to it.—Springfield Republican.

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Adjustable Spring Jig.

The accompanying cuts show the construction of an adjustable jig which may be used for accurately spacing holes in flanges, cylinder heads, couplings and other pieces where the holes are required to be located symmetrically. Fig. 1 is a plan of the jig alone, and Fig. 2 is an elevation, with partial vertical section of the jig, with a flange coupling (a very light one, by the way) secured in position for drilling. The jig is suitable for use upon any upright drill of suitable size. The circular base *A* has two lugs on opposite sides by which it may be bolted to the drill table, and on one side, midway between these lugs, is an extension to which is bolted the adjustable drill guide. This guide may be adjusted for hight, and also for different radial distances. It should also be provided with

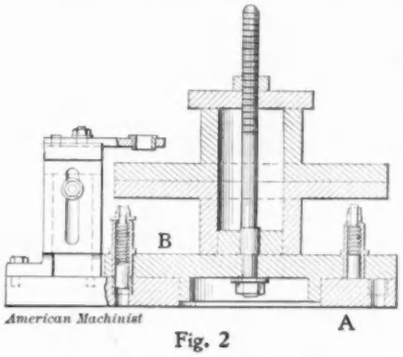

Fig. 2

ADJUSTABLE SPRING JIG.

bushes of different sizes to correspond to the drills that may be used. The base plate *A* is also the index plate of the device. Near the periphery are located, in the plate as here shown, eight accurately spaced holes, with six holes a little farther in. The number of holes may be whatever is most suitable for the line of work on which the jig is used. The revolving plate *B* has the work to be drilled concentrically located and fastened to it, as the flange coupling shown. The drill guide being set at the correct radial distance, the first hole is drilled with the spring pin dropped into a hole in the base and locking the work. When the drill is withdrawn the spring pin is raised and the work is turned around until the pin drops into the next hole. The spring locking pin for the circle not in use may be raised out of contact with the lower plate and locked by giving it a quarter turn, the cross handle then resting on the top of the spring case. This jig has been recently patented by Michael H. McArthy, Cleveland, Ohio.

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An Accommodating Chuck.

The chuck shown herewith is not only self-gripping and self-releasing, but also will drive the work when the axis is not parallel to the chuck axis. It is designed for use in screwing in stay bolts and similar purposes. The shank may be driven by a flexible shaft or other means of connection with a suitable motor.

The construction of the chuck will be understood by reference to the vertical section, Fig. 1. Fig. 2 shows the lower face of the chuck with the gripping jaws or cams which seize and drive the work. The case *A* is driven by the shank *B*. When the threaded ring *L* is screwed home the interior is bored out spherically, and in this fits easily the jaw block *C*, which, with the top and bottom plates *F* and *G*, are turned externally to a true spherical surface. The plates *F* and *G* are held to the jaw block *C* by the long round-headed screws tapped into the upper plate. These plates hold in place endwise the three gripping jaws *E*. These jaws are cylindrical on the back and set in cylindrical grooves in the jaw block, which permits them a limited movement of revolution. The inner faces of the jaws are taper and also eccentric, and provided with hardened ratchet teeth. The pins *H* have

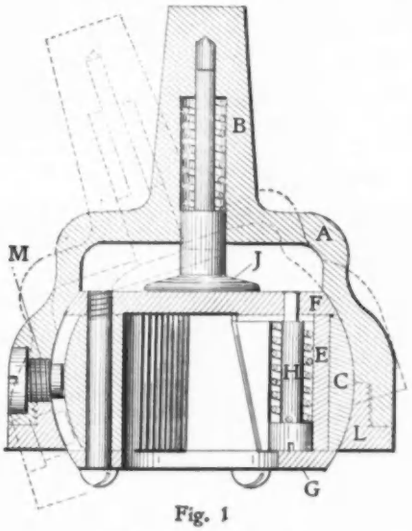

Fig. 1

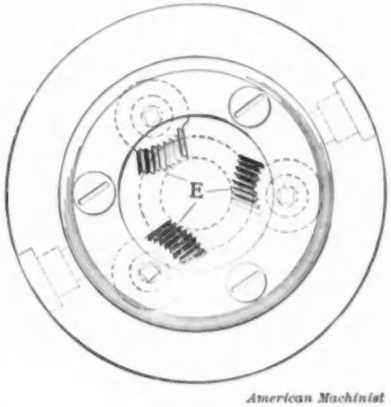

Fig. 2

CHUCK FOR DRIVING STAY BOLTS.

square shanks fitting in the upper plate *F* to prevent their turning, and these pins hold the springs *I*, which hold the jaws swung open, or at the largest internal diameter. The jaw block *C* has two opposite grooves in which fit loosely the tits of two screws *M*. These screws serve to drive the jaw block and jaws with the case, and yet permit the jaw block to tip as may be required to accommodate between the work and the means of driving. The plate *F* being flat on top, the pressure of the flange *J* tends to keep the axis of the jaw block

parallel and in line with the axis of the case, but this flange with the spindle above it, which is solid with it, and the spring constantly pressing downward, still permit the jaw block to tip as may be necessary. The chuck being slipped over the end of a stay bolt and the power applied, the jaws at once grip and drive it. When the motor is stopped and the turning ceases a slight backward movement of the chuck at once releases it from the work. This chuck has recently been patented by La Roy Bartlett, St. Louis, Mo.

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The eighth annual meeting of the American Association of Inventors and Manufacturers will be held in the City of Washington commencing the 18th of the present month. Among other things to be considered by the association will be the matter of obtaining legislation authorizing the Patent Office to expend some of its surplus income in making more thorough investigations of applications for patents with a view to excluding those things which are not new.

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It is announced that there will be opened in London May 1 an exhibition of inventions and manufacturers. It is under the direct management of Mr. Imre Kiralfy, who is well known as a manager of such enterprises, and who, being an American citizen, gives assurance that Americans desiring to take part in this exhibition will be liberally dealt with. The site of the exhibition is to be in Earl's Court, where a tract of 22½ acres is being fitted by the erection of small buildings, &c. Identified with Mr. Kiralfy is a very formidable list of prominent men in Great Britain. Those who may wish further particulars regarding the exhibition can obtain them by addressing the Secretary, London Exhibitions, Limited, London, S. W., England.

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One of the most healthy of all businesses to-day is probably that of copper production. There are no copper combinations or trusts, and a protective tariff is impossible as the United States produces 60 per cent. of all the copper of the world. All the American mines were operated uninterruptedly last year. Employés worked every day at fair wages, and the mines paid satisfactory dividends. The consumption of copper increases much more rapidly than the production, and an actual scarcity of the metal is a not very remote possibilitty. The American output for 1897 is estimated at 214,000 tons.

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Robert Pittius, employed in a tannery at Elizabeth, N. J., wears long hair. If he continues to live he may decide to have it cut. While leaning over a machine recently to examine the lathe his hair was caught in the gears, he was lifted from his feet and whirled around, his screams bringing his fellow-workmen to his rescue. His head was badly cut and he was unconscious when released. While this is perhaps a lesson about hair cutting, it ought also to again remind us that gear wheels should be shielded. They are always dangerous.

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In the course of a personal letter Prof. John E. Sweet asks "Why did not the fellow who invented the rim drilling machine illustrated in your issue of December 30, 1897, put little wheels on the back ends of the drill spindles to friction on the cone and so run the spindles by the cone and do away with the gears? It will work all right."

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Commercial Review.

NEW YORK, Saturday Evening, Jan. 8, 1898.

INDUSTRIAL AND FINANCIAL CONDITION OF THE ENGINE TRADE.

We have addressed a number of inquiries concerning the present outlook of the steam engine business to manufacturers in that line, particularly those located in the Central West. The replies received are not many, but they suffice to establish two propositions.

The first of these is, That in regard to volume of business the engine trade is manifesting material improvement. This, of course, is the crucial test of prosperity, and since its results are satisfactory we may be sure that other conditions will adjust themselves thereto.

The second feature is the demoralization of prices. This is brought out distinctly in three of the four letters, although in our inquiry we made no particular reference to that point. Plainly, therefore, it is uppermost in the minds of manufacturers.

Although in this matter what is one man's meat is another man's poison, and extravagant profits upon a class of necessities such as steam engines are to be deprecated, it is in conformity with the best interests of the community at large that manufacturers should receive adequate compensation for their goods and remuneration for their labors.

We have little fear that with a continued improvement in demand the prices will not rectify themselves. This is to be accomplished not by a trust or combination, the idea of which in a line of industry so widely apportioned as the engine trade would be chimerical, but by an appreciation upon the part of builders that good times are coming back again and a sturdy determination by them to stand out for reasonable profits.

As we have before remarked, in the electrical field the hard times have served to introduce economies in manufacturing methods and thus to reduce prices, perhaps for the permanent benefit of the consumer. In the engine industry, however, there were not so many economies feasible to make, and it is reasonable to suppose that ere long builders will be setting themselves about to retrieve a part of their lost monetary ground. At any rate, by the tide of advancing prosperity, the continued sacrifice of values should immediately be checked.

From the Edward P. Allis Company, Milwaukee, Wis.:

"As to the outlook for the coming year's business, would say that we consider the prospect encouraging. We have a large amount of work on hand and our order book is well filled for future deliveries."

From the Philadelphia Engineering Works, Philadelphia, Pa.:

"We find the general business prospects very greatly improved over those of the corresponding period last year, and from present indications believe that the spring of '98 will develop considerable volume of business. Prices, however, do not improve, as we would like to see them. We are, at the present time, building several large mill engines, to be shipped into South Africa; also a complete air compressing plant, with motors, etc., for gold mining properties in Mexico."

From the Ball Engine Company, Erie, Pa.:

"Our opinion of the engine business of 1897 is that it has been poor in amount the first six months, and especially bad in prices for the whole of the year. Referring to our own experience—since July 1 last—we have run full time and full handed, and since October 1 last we have run our plant thirteen hours a day and are now doing so, and have a fair number of orders ahead. We think the prospects for 1898 are for better business in amount. The demoralization in prices, however, still continues, and if not corrected a lot more 'lame ducks' will be added to the already large list. The problem is how to get the engine men to brace prices up from the trough of demoralization."

From an engine building company in the Central West:

"In regard to the prospects for the steam engine business for the present year, we believe it is a fact at the present time that most engine builders are busy. This refers to engines particularly. We are manufacturers of boilers also, and our boiler department is not so busy. That the boiler department should not be busy at this time of year is not astonishing, however, because it is always the case that the boiler business drops off with the coming of freezing weather and does not pick up again until things thaw out in the spring. The engine business is not so. At the present time we are working our full force on engines and some days we are working overtime. Prices have not yet advanced, and it is a curious fact that if other people are as busy

as we are this should be the case. It is our opinion that with the opening of spring trade in full blast, all engine builders will be reasonably busy; busy enough to put on an air of independence which they have not worn for four or five years, and with this air of independence will come the advance in prices, although it will be, in our opinion, gradual. American business, so far as we have found it, has decidedly improved, but it can stand a great deal more improvement, especially in prices, before the engine and boiler builders will be satisfied; and they, as a class, are not very hard to please either."

MISCELLANEOUS NOTES.

From Warner & Swasey, Cleveland, Ohio:

"We are glad to tell you that the year just ending has been a prosperous and successful one for us, the amount of business done equaling that of our best year up to the present time. A considerable portion of the year's business has come from foreign countries, but the last few months have shown a marked improvement in the American market. We look for a good year in 1898, especially as there seems to be a steady increase in American demand for machine tools."

The Joseph Dixon Crucible Company, Jersey City, N. J., have said their New Year's say upon the topic "Something About Business" in a little circular which in slightly abbreviated form is as follows:

"In 1893 it was a case of business paralysis, in 1894 we had a year of debility, in 1895 the patient partially revived, in 1896 came a relapse, but in 1897 came recovery and the patient took up his bed and walked. The great medicine man was dollar wheat and thirty cent corn, plus poor harvests at this exigency abroad. The industrial triumphs of 1897 are important. Export trade was larger in the fruits of the harvest, and particularly in manufactured goods, than in the history of the country. Americans are competing in every market. American motors won the order in London. On a bridge in Holland an American firm was the lowest bidder. American steel rails go regularly to China, Japan and India. A movement is on foot to have the English Parliament pass a law changing the stamp on goods not made in England, to "Abroad" simply, instead of the name of the country where they are made. This is an effort on the part of the English lawmakers to obscure the origin of these goods. For the Dixon Company personally, we have shared in the general prosperity. Perhaps the outlook was never more inviting."

William H. Wood, engineer and builder of special machinery, Media, Pa., sends us a list of orders for hydraulic riveting machinery, etc., recently filled. We notice

Continued on page 38.

Business Specials.

Gear wheels, gear cutting. Grant; see page 16.

Forming Lathes. Mer. Mach. Tool Co., Meriden, Conn.

Selden Packing for stuffing box, with or without rubber core. Randolph Brandt, 38 Cortlandt st., N. Y

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Wants.

Situations and Help Advertisements only inserted under this head. Rate 30 cents a line for each insertion. About seven words make a line. The cash and copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Situations Wanted.

Experienced mech. draftsman. Box 137, AM. MACH.

By good pat. office draftsman. Box 14, AM. MACH.

Mech. draftsman and mchst.; exper. steam, marine pump, gen. mach.; desires position. Box 18, AM. MACH.

An accurate and industrious mech. draftsman desires a situation; can give best references. Box 2713, Station J., Philadelphia, Pa.

A practical up-to-date foundryman desires position; familiar with heavy and light mach., eng. and boiler castings; good habits, good ref. Box 12, AM. MACH.

Experienced salesman or supt. desires engagement with first-class mach. comp. in either of above positions; 15 years with last comp.; ref. Box 19, AM. MACH.

Brass molder wants a position; experienced, practical and competent in all the details of the trade; if desired can take financial interest. Address C. E., 1417 Omer street, Indianapolis, Ind.

First-class machinist desires steady position in mfg. company or assembling complicated mach.; age 30; strictly sober habits; faithful, energetic and conscientious worker with wide exp. Box 16, AM. MACH.

Situation wanted as factory manager or supt. by practical inventive machinist; 20 years' experience supervising manufacturing; very successful in past; best of references from last employers and others. Box 5, AMERICAN MACHINIST.

Investigate This—A mechanical engineer with long experience, thoroughly posted on the design and mfr. of electrical apparatus, at present with large electrical concern, desires change; superintendent or chief engineer. Address Box 17, AMERICAN MACHINIST.

A thoroughly competent M. E. would like to correspond with parties in need of an up-to-date mgr. or supt., with a view to financial connections; can readily adapt himself to local trade or design special machinery; parties dissatisfied with present management will do well to address Box 1, AM. MACH.

Help Wanted.

Wanted—Man to install high speed engines direct connected to dynamos. Address Box 3, AM. MACH.

Draftsman—Mechanical draftsman wanted on tool and jig work; man with shop experience preferred; state references. Box 21, AMERICAN MACHINIST.

Wanted—Toolmaker experienced on tools and jigs for manufacturing lathes economically; give experience, wages and ref. Box 15, AMERICAN MACHINIST.

Gun and locksmith and bicycle repair man wanted in a Montana city; must be a first-class mechanic and thoroughly experienced; give age, experience, references and wages wanted. Address Box 9, AM. MACH.

Wanted—Man familiar with the design and use of tools for making brass fittings to organize and manage a large department for the manufacture of brass goods. Call or address Aermotor Co., Twelfth and Rockwell Streets, Chicago, Ill.

Practical organizer of systematic piece work; ten years superintendent where special attention has been given to production of duplicate parts at lowest cost, and making tools for the same; inquiries cheerfully ans.; ref. given. Address "Organizer," AM. MACH.

Engineer, 32, thorough tech. education; member A. S. M. E.; splendid experience as constructing eng. and manager, desires change; knows modern methods of mach. designing and shop practice; immense exp. on construction Corliss and other engs., air compressors, ice machs. and the most improved gas eng. practice; competent to assume charge of works of any magnitude; pos. as gen. supt. or chief eng. wanted; highest testimols. from all past employers. Box 20, AM. MACH.

Wanted—For a machine tool works in England, several first-class machinists used to assembling plain and automatic screw machines, etc., of the best class. A splendid opening for really first-class men at good pay and permanent jobs if suitable. No dispute of any kind. Reply giving full particulars of experience, age, salary, BOX 8, AMERICAN MACHINIST.

Miscellaneous Wants.

Advertisements will be inserted under this head at 30 cents per line, each insertion. Copy should be sent to reach us not later than Saturday morning for the ensuing week's issue. Answers addressed to our care will be forwarded.

Job lot radiators, 12-2c. ft., S. M. York, Cleveland, O.

Book, Dies & Die Making, $1. J. L. Lucas, Prov. R. I.

I make dies; send sample and see what they cost, J. L. Lucas, Providence, R. I.

The Dutton Wet Twist Drill-Grinder is sold by the Garvin Machine Co., New York City.

Best and cheapest Bolt Header, made by Baush & Harris Machine Tool Co., Springfield, Mass.

Light and fine mach'y to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

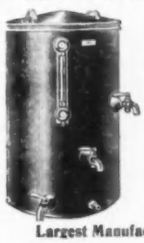
For Sale—Second-hand drill presses, engine lathes and planers. Dietz, Schumacher & Boye, Cincinnati, O.

Wanted—Makers of automatic machines for the production of studs and rollers for bicycle chain. Address BOX 143, AMERICAN MACHINIST.

Lathes, planers, drills, milling machines, vises, also brass working machinery second-hand; must be modern and in first-class condition. C. C. Wormer Machinery Co., Detroit, Mich.

Representation in Europe sought. First-class mfrs. of mach. tools and new specialties are requested to send their catalogues, price lists, with discount sheets, to "Cyclop" Mach. Ag'y, IV. Hauptstr., 46, Vienna, Aus.

THE CROSS OIL FILTER



actually reduces oil bills 50% or more. Sent on approval. Used in 14 countries. Testimonials from leading firms in every field of industry.

Business established seven years

THE BURT MFG. CO.
AKRON, O., U. S. A.
Largest Manufacturers of Oil Filters in the World.

WOODWORKERS

BUCK CAST BROS. STEEL

Pattern Makers' Gouges, Woodworkers' Chisels, Gouges, Turning Tools. Send for Price List.
BUCK BROS., Millbury, Mass.

HARTFORD STEAM BOILER INSPECTION AND INSURANCE CO.
HARTFORD, CONN.

J. M. ALLEN, President.
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F. B. ALLEN, Second Vice-President.
J. B. PIERCE, Secretary and Treasurer.

THE POWELL PLANER CO.
WORCESTER, MASS.

Agents: U. Baird Machinery Co., 125 Water St., Pittsburgh, Pa. J. A. Fay & Egan Co., 26 So. Canal St., Chicago, Ill. Robinson & Cary Co., St. Paul, Minn. Colcord & Sanderson, 502 North Second St., St. Louis, Mo. Parke & Lacy Co., Fremont St., San Francisco, Cal. The Fairbanks Co., 705 Arch St., Philadelphia, Pa.

Continued from page 37.

among the companies who placed orders the following: Cooke Locomotive Works, Dickson Locomotive & Machine Works, Chas. Hillman Ship & Engine Building Company, National Tube Works, Du Bois Iron Works, Enterprise Boiler Company and others.

▲ ▲ ▲

Quotations.

NEW YORK, Monday, January 10.

Iron—American pig, tidewater delivery:

No. 1 foundry, Northern	$11 75 @	$12 00
No. 2 foundry, Northern	11 25 @	11 50
No. 2 plain, Northern	10 75 @	11 00
Gray forge, Northern	10 25 @	10 50
No. 1 foundry, Southern	10 75 @	11 00
No. 2 foundry, Southern	10 25 @	10 50
No. 3 foundry, Southern	10 00 @	10 25
No. 1 soft, Southern	10 75 @	11 00
No. 2 soft, Southern	10 25 @	10 50
Foundry forge, Southern	9 75 @	10 00

Some Northern irons tend lower than the above figures.

Bar Iron—Base—Mill price, in carloads, on dock: Common, 1.07½ @ 1.10c.; refined, 1.12½ @ 1.20c. Store prices: Common, 1.25 @ 1.35c.; refined, 1.30 @ 1.50c.

Tool Steel—Ordinary sizes, standard quality, 6 @ 7c., with some grades perhaps a little less; extra grades, 11 @ 12c.; special grades, 16c. and upward.

Machinery Steel—Ordinary brands, from store, in small lots, 1.50c.

Cold Rolled Steel Shafting—Base sizes, from store, in small lots, 2.25 @ 2.30c.

Copper—Carload lots, Lake Superior ingot, 11c.; electrolytic, 10¾c.; casting copper, 10½ @ 10¾c.

Pig Lead—Carload lots, 3.70c., f. o. b., New York.

Pig Tin—For 5 and 10-ton lots 13.85 @ 13.90c., f. o. b.

Spelter—Carload lots, 3.90 @ 4.00c. for good brands, New York delivery.

Antimony—Japanese, 7¼ @ 7⅜c.; Hallett's 7.45c.; Cookson's, 7¾c. and upwards on small lots.

Lard Oil—Prime city, present make, commercial quality, in wholesale lots, about 40c.

▲ ▲ ▲

Manufacturers.

The American Steel & Wire Company of Chicago has been incorporated.

At Courtland, Ala., G. A. Benner contemplates opening up a new planing mill.

Eastepp, Foster & Co., of Music, Ky., are to move their business to Gallatin, Tenn.

The Durango Iron Works, at Durango, Col., has recently been destroyed by fire.

Mr. A. W. Miller, of Riverside, Cal., is contemplating the erection of his planing mill at an early date.

The plant of the Copake Iron Company is expected to be removed from Copake to Dennings' Point, N. Y.

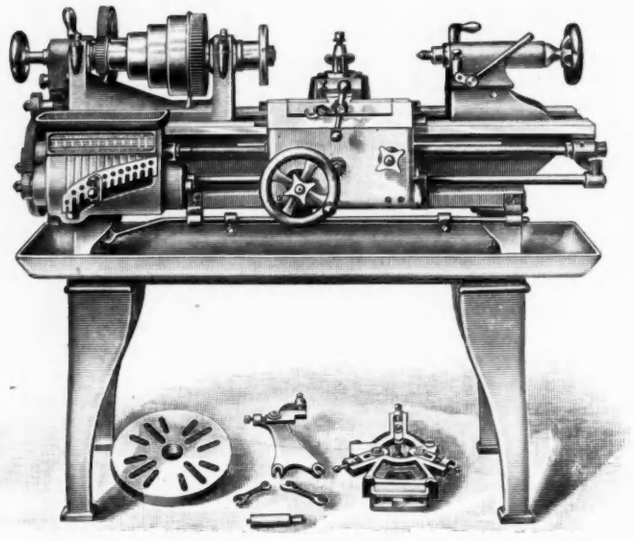
At McKees Rocks, Pa., the Daisy Washing Machine Company contemplates the erection of a plant. Mr. Frank Hieber is interested.

At Chicago, Ill., the Crescent Drop Forge Company has been incorporated. Ed. Sendelback, Ferd. Barnickol and Ed. Barnickol are the incorporators.

The Excelsior Stamping & Metal Company of New York City has been incorporated by Sender Jarmulowsky, Meyer Jarmulowsky and Louis Jarmulowsky.

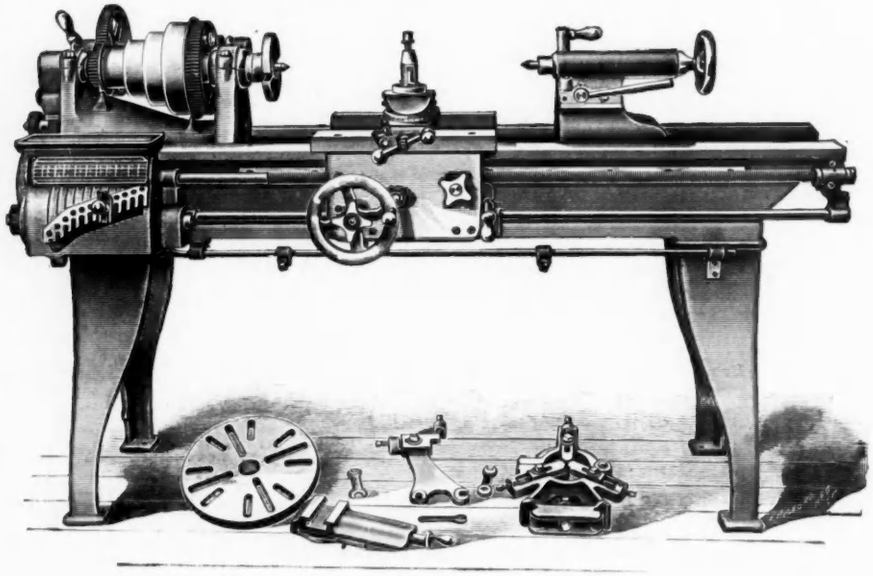
It is reported that Mr. George D. Todd, of Louisville, Ky., and others are interested in the construction of a building at New Albany, Ind., to be used for manufacturing purposes.

The Dancel Machine Company, of New York City, has been incorporated to manufacture boot and shoe machinery. Directors: Christian Dancel, of 1708 Putnam avenue; Charles T. Close,



12" Hendey-Norton Lathe

is fitted with drawing-in sleeve and American Watch Tool Co.'s standard chuck, used in making small taps, reamers, etc. Work finished first and cut from bar afterward. No centering required. See carriage reverse lever by right-hand side of apron ; no reaching for countershaft shipper required.



14" x 6' Hendey-Norton Lathe.

These lathes are modern, high-grade, practical tools, and are specially adapted for tool-room work. They have the Norton Attachment for screw cutting, giving 36 different threads and 36 different feeds with only two changes of gear and movement of lever in gear box from one notch to the other. Note the automatic stop under apron. It will automatically stop carriage at any desired point in either direction; invaluable for internal or duplicate work. SEND FOR CATALOGUE.

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Torrington, Conn.

Agents for the Pacific Coast, Pacific Tool & Supply Co., San Francisco, Cal.
J. W. Cregar, Philadelphia Bourse Exhibition.

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Chas. Churchill & Co., Ltd., London and Birmingham, Eng.
Adphe. Janssens, Paris, France.
Eugen Soller, Basel, Switzerland.

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Complete Patent Combination Square and Bevel Protractor.

9 in., List Price, $4.50 Net Special Offer, $2.25
12 " " " 5.00 " " " 2.40

Special Cash Offer on Twist Drills.

Twist Drills in sets 1/16 to 1/2" by 64ths difference. List, $10.00. Our Special Offer, Net, $2.88
Twist Drills in sets 1/16 to 1/2" by 32nds difference. List, $5.40. Our Special Offer, Net, $1.60
Twist Drills in sets Nos. 1 to 59 Alternate Gauges. List, $4.30. Our Special Offer, Net, $1 25
Set of Taper or Straight Shank Drills, 1/4 to 1", varying by 16ths. List, $20.00. Our Special Offer, Net, $5.65

Special Offer Sheet mailed monthly if desired, on receipt of request.

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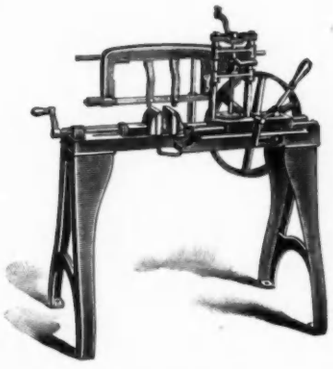
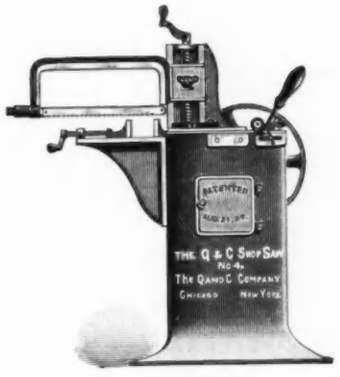


Special Machinery For Cutting All Kinds of Iron and Steel Cold. . . . . .



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700-709 Western Union Bldg., CHICAGO, ILL.

100 Broadway, NEW YORK, N. Y.

537 Mission Street, SAN FRANCISCO, CAL.

of Brooklyn, and Henry Briggs, of Hasbrouck Heights, N. J.

Wm. A. Heimgartner is to have an addition erected to his plant.

Mr. Jacob Ebert is soon to erect at Palatka, Fla., a brick plant.

Messrs. Knapp will re-establish the button factory at Deposit, N. Y.

The Detroit (Mich.) Soap Company is to construct an addition to its plant.

The Bath Iron Works, Bath, Me., is to make additions to its joiner shop.

It is reported that a phonograph factory is to be erected at Muskegon, Mich.

At Greene, N. Y., the plant of the Lyons Iron Works has been destroyed by fire.

The Kimber Wire Manufacturing Company is to remove its plant to Chicago Plains.

The Keasbey & Matteson Company are preparing to enlarge their works at Ambler, Pa.

Franke Bros., of Fostoria, Ohio, contemplate the erection of a new flour mill at that place.

The National Boiler Works, at Bay City, Mich., have recently been destroyed by fire.

The Bay View plant of the Illinois Steel Company is to undergo extensive improvements.

The saw mill of A. M. Shackford, at Canaan Centre, N. H., has been destroyed, with all machinery.

The Pulaski (Va.) Milling & Mining Manufacturing Company will add new machinery in a short while.

The Champion Novelty Company, of Dayton, Ohio, contemplates the removal of their plant to Marysville, Ohio.

Irvin Robbins & Co., of Indianapolis, Ind., has been organized for the manufacture of carriages, buggies, &c.

It is reported that Howard Jones, a Toledo man, is interested in a dynamite factory at Bellefontaine, Ohio.

The Michigan Sugar Company, of Bay City, Mich., is to build a plant at Essexville. This factory will be 900 feet long.

E. B. Jones & Co., of Mount Holly, N. J., have leased the Van Brunt factory at Beverly and converted it into a factory.

The Jacob Knitting Company, 443 Greenwich street, New York, contemplates the erection of a new factory at Newark, N. J.

The Vulcan Iron Works, of Wilkesbarre, Pa., is to have additions made to its plant. This addition will be used for a boiler shop.

The Carolina Ice Company, of Wilmington, N. C., will place additional machinery, sufficient to double its capacity.

The National Box & Lumber Company, of Boston, Mass., has been incorporated. Mr. Holton Wood is president and treasurer.

Schmidt Bros., of West Superior, Wis., have received a contract to erect a 150x175-foot machine shop for the Eastern Minnesota Railroad.

At Deshler, Ohio, House, Heflinger & Co., T. M. Gehrett and Troup Bros. have formed a company for the establishment of a foundry and machine shop.

At Anderson, Ind., the Richard Thomas Brass Foundry Company has been organized. The stockholders are Richard Thomas, T. J. Morgan and Alexander Jones.

Messrs. Wyman & Gordon, manufacturers of hydraulic drop hammer forgings, Worcester, Mass., have just added a large Root's positive pressure blower to their plant.

The Colonial Electric Company, of New York City, has been incorporated by Garrett S. Odelt, Orion H. Cheney, of New York City, and Horace S. Andrews, of Brooklyn.

The Saranac Lake (N. Y.) Light, Heat and Power Company has been incorporated. The capital stock is $100,000, and the directors for the first year are Orlando Blood, Wallace Mur-

ray and Perley A. Gould, of Saranac Lake, and F. A. Isham and C. S. Stackpole, of New York City.

Kelley, Spear & Co., of Bath, Me., are building an addition to their mill.

A syndicate has been formed to construct an electric road from Kansas City to Topeka. Hon. E. B. Purcell is interested, as is also John G. Johns, of Houston, Tex.

The plant of the Armington & Sims Engine Company, Providence, R. I., was sold recently for $40,000 to Jas. M. Scott. The property is subject to a mortgage of $80,000.

Peck Lacing Hook Company has been organized at Kittery, Me., for the purpose of manufacturing hooks for lacing shoes, corsets, &c. Ira F. Peck, of Auburn, R. I., is the president.

The Potomac Clay Company has been incorporated. Among the directors are G. E. McComber, C. R. Wilson, J. E. Brown and N. S. Greenaway, all of Washington, D. C.

The name of the Sulzer-Vogt Machine Company, Louisville, Ky., has been changed to that of the Henry Vogt Machine Company. The management of the company will be the same as heretofore.

The Rhode Island Locomotive Works, of Providence, R. I., was sold January 6. Mr. Eugene W. Mason, of John H. Mason & Sons, secured the plant for $130,000.

The Stanley Instrument Company is to erect, at Great Barrington, Mass., a factory in which electrical instruments are to be used. Frank H. Wright, of Great Barrington, is president of the company.

The Diesel Motor Company, of America, the offices of which will be in New York, has been incorporated. The directors are C. F. Wilson, Percy Thorpe, John C. A. Tutor and G. Franklin Bailey, all of New York City.

At Mechanic Falls, Me., the J. W. Penney & Sons' Company has been organized for the purpose of carrying on a machinist and foundry business. Samuel R. Penney is president and Almont R. Penney is treasurer.

▲ ▲ ▲

New Catalogs.

There are three sizes of Standard Catalogs, first authorized by the Master Car Builders' Association, 9" x 12", 6" x 9" and 3½" x 6". We recommend the 6" x 9" size for machinery catalogs. When they must be larger or smaller, one of the other standard sizes should be adopted if possible.

The Wheeler Condenser & Engineering Company, of New York, sends us a catalog of surface condensers, water towers, &c. The catalog is 6 x 9¼ inches.

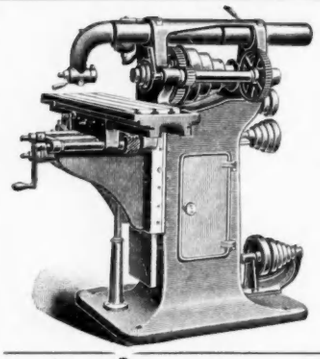
We have received from the Hendey Machine Company, Torrington, Conn., an illustrated catalog of lathes, shapers and vises. The catalog is standard size, 6 x 9 inches.

Waterbury Farrel Foundry & Machine Company, Waterbury, Conn., sends us catalog E of foot, drop and screw presses. The catalog is 6 x 7 inches.

The Walker Company, of Cleveland, Ohio, sends us a catalog describing a new type of platform controller called Type S Solenoid Blow-Out Controller. That catalog is daintily gotten up, and is 5½ x 7 inches.

We have received from Samuel Carey, New York, a catalog of cocoa and chocolate machinery, including roasters, separators, melangeurs, &c. The catalog contains a detailed description of the various machines, together with prices of the same, and is standard size, 6 x 9 inches.

We have received from the L. S. Starrett Company, Athol, Mass., a copy of catalog No. 15, in which is described and illustrated a large variety of machinists' tools, such as squares, calipers, rules, gages, &c., also milling cutters. The catalog contains 112 pages, and is 5¼ x 7½ inches.



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IN FOUR SIZES.

No. 0 and No. 1 with and without overhanging arm and backgear. No. 2 and No. 3, shown in cut, have reversible feed. All have self-acting screw feed and stop motion, and tables have patent adjustable stop mechanism which prevents breakage of teeth when the work is run up to the cutters. Their stiffness and power fit them to do their work rapidly and smoothly, with long life to themselves and the mills.

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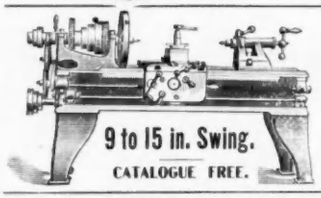

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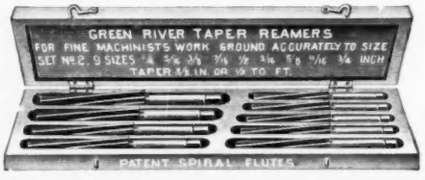
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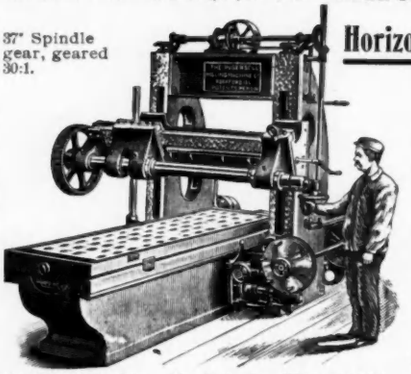

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SIZES:
15", 20" 24", 36", 48", 60", any length.

Wide range of cutter speeds.
Variable table feed from 3-16" to 10" per minute.
Power elevating and lowering device.
Table adjusted by power in either direction.

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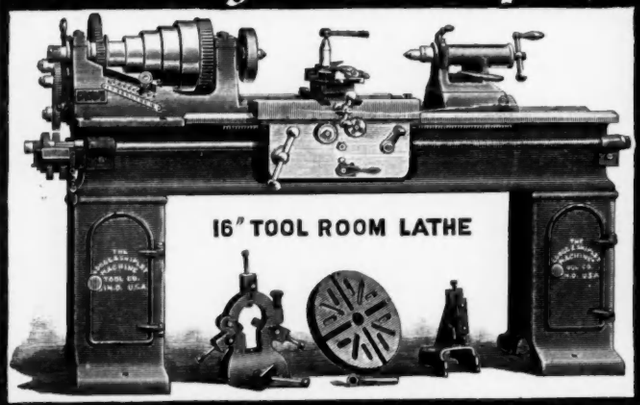

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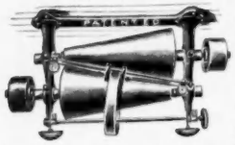

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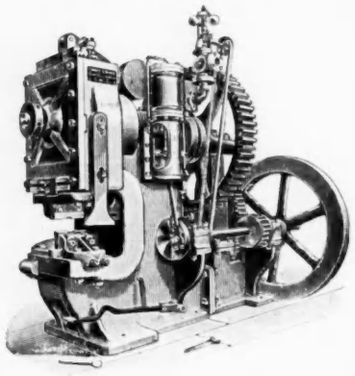

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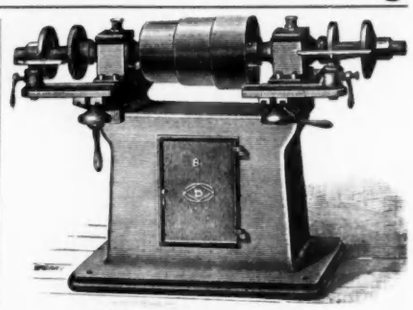

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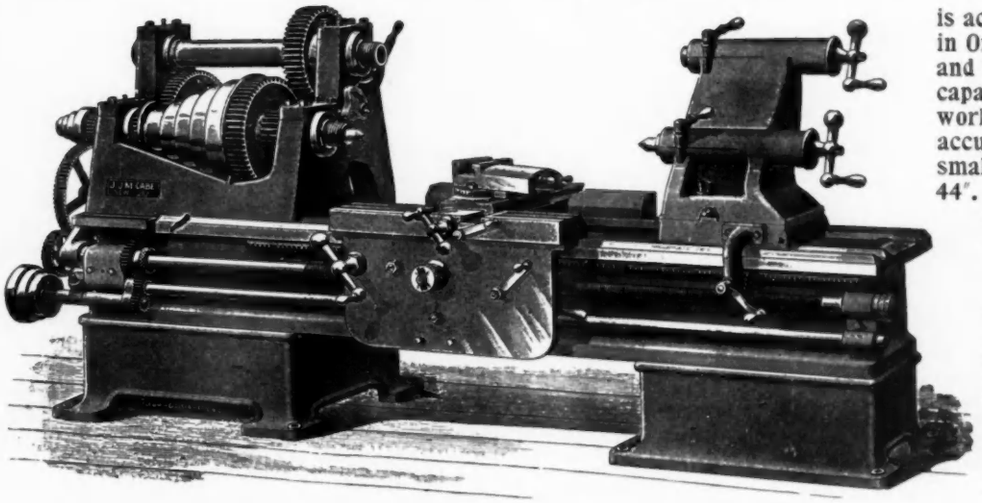

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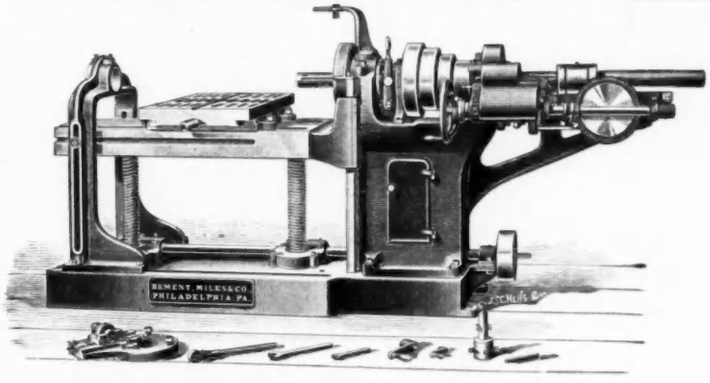

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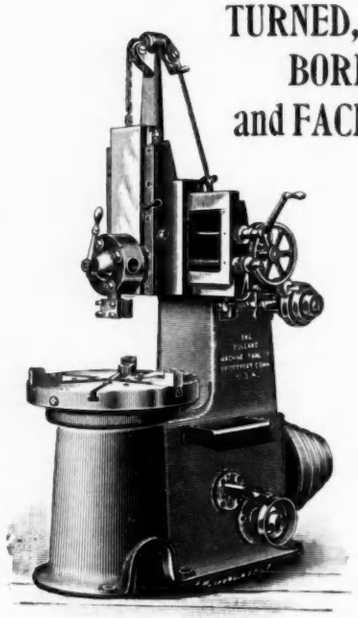

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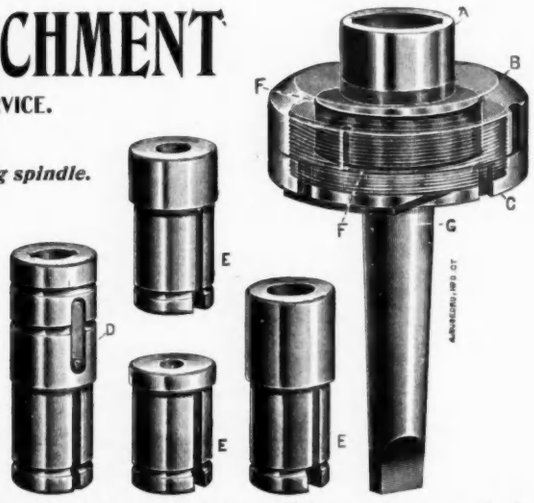

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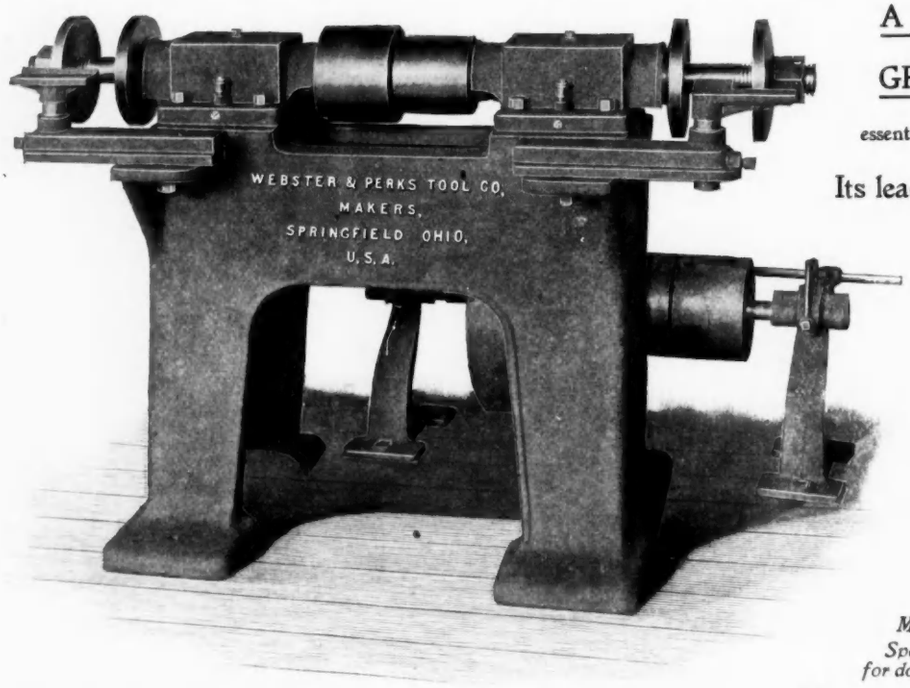

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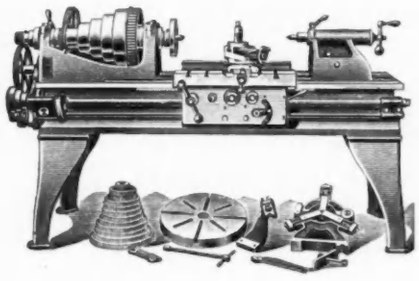

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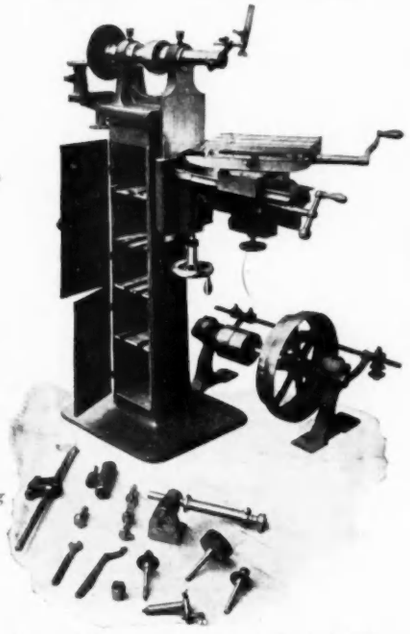

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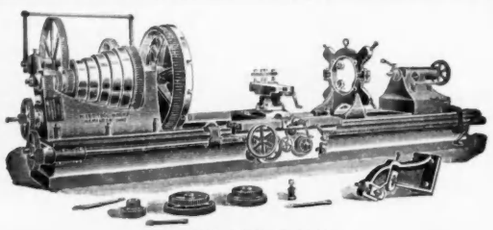

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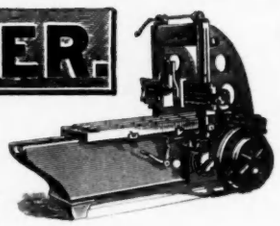

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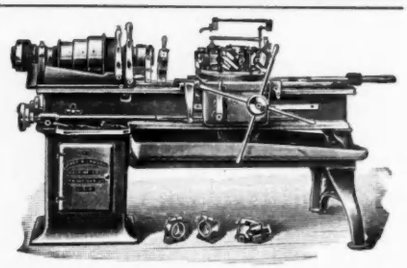

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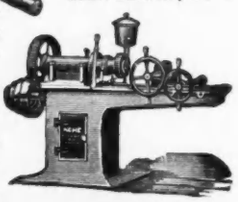

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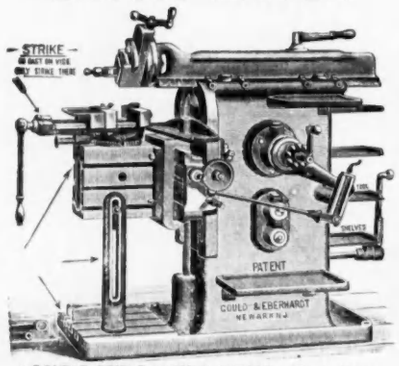

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